

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
SAN FRANCISCO BAY REGION

ORDER NO. 95-136  
(Revision of Order No. 95-018)

REVISED SITE CLEANUP REQUIREMENTS FOR:

CITY AND COUNTY OF SAN FRANCISCO

and

SAN FRANCISCO INTERNATIONAL AIRPORT TENANTS:

**AIRLINE TENANTS:**

American Airlines  
Delta Airlines, Inc.  
Federal Express  
Japan Airlines  
Quantas Airways  
Trans World Airlines  
United Airlines

**CONCESSIONAIRES:**

Avis Rent A Car System, Inc.  
The Hertz Corp.  
National Car Rental System, Inc.

**AVIATION SUPPORT TENANTS:**

Chevron U.S.A Inc.  
Chevron Corporation  
Ogden Allied Ground Services  
P.S. Group, Inc.  
Santa Fe Pacific Pipeline Partners, L.P.  
Shell Oil Company  
Signature Flight Support-  
San Francisco, Inc.  
Texaco Refining and Marketing Inc.  
Unocal Corporation

**GOVERNMENT AGENCIES:**

United States Coast Guard  
Federal Aviation Administration

FOR THE PROPERTY AT:      **SAN FRANCISCO INTERNATIONAL AIRPORT,  
SAN MATEO COUNTY**

**FINDINGS**

The California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter called the Regional Board), finds that:

**1. SITE DESCRIPTION**

- a. Site Ownership / Location The site is owned by the City and County of San Francisco which operates the San Francisco International Airport. Although it is owned by the City and County of San Francisco, it is located within San Mateo County and is bounded by the cities of South San Francisco, San Bruno, Millbrae, and Burlingame (see Figure 1).

- b. Airport Operations The Airports Commission is the governing body in charge of overseeing all airport activities. In order to facilitate airport operations, the Airports Commission leases out and issues permits for the use of parcels, known as plots, within the airport boundaries to various airlines, aviation support companies, and concessionaires, such as ground transportation companies, who operate within their leasehold agreement areas. In addition, the Airports Commission leases out or issues permits for other areas to agencies such as the federal government. The areas and agreements change depending upon the needs of both the Airports Commission and tenant operations.
- c. Adjacent Properties Land uses in the area vary depending upon which side of the airport. The San Francisco Airport is bounded on the north by San Bruno Channel. Directly across the channel is a commercial / industrial area which includes the Shell bulk terminal, the San Bruno sewage treatment plant and a shopping center. The San Francisco Bay lies to the east of the airport and the runways actually extend into the Bay itself. To the south is a park where jogging trails and a wetland area are surrounded mainly by hotels servicing airport travelers. To the west, directly adjacent to the airport, are federal jurisdictional wetland areas that provide habitat for the red legged frog, a potential candidate for threatened species list. This small wetland area continues on the other side of the Bayshore freeway (Highway 101) which runs parallel to the airport. Beyond this wetland to the west are residential neighborhoods.

## 2. SITE HISTORY, PRESENT AND FUTURE USAGE:

- a. The San Francisco International Airport has been in existence since the 1920's when it began as a small airfield. Through reclamation of baylands, filling of the Bay, and acquisition of adjacent property, it has expanded to its current size of approximately four and one half square miles.
- b. Historical and current property use include passenger transport both via air and ground support vehicles, cargo transport and associated facilities operations, maintenance operations for both airplanes and ground support, a U.S. Coast Guard facility, a fuel distribution depot, a pressurized aircraft fueling network, a materials testing laboratory, storm water holding basins, a domestic waste water treatment plant, and an industrial waste water treatment plant. In addition, the Airport was also used as a military airfield, including barracks, during World War II. Five of these facilities are currently regulated under other Board orders (three SCRs and two NPDES). Those Orders shall remain in effect, in addition to the requirements of this Order. Due to time constraints associated with the Master Plan Expansion project (See Finding 2c) and the need for the establishment of cleanup objectives prior to commencement of construction activities, staff were unable to incorporate the existing SCRs into

this Order. It is the Board's intent that this Order will be amended to incorporate the requirements of these three Orders into this Airport wide Order as soon as staff resources permit.

- c. The airport is undergoing a major Master Plan expansion project which will result in an approximately 35% increase in total building square footage which will significantly increase its passenger handling capacity. As part of this \$2.4 billion expansion project, the airport has been systematically evaluating (i.e. plot by plot) the environmental conditions of the airport properties. To date, numerous investigations have been performed under the direction of both the Airports Commission staff and the tenants. As a result, certain areas have been found to contain pollution within the subsurface soils that could or do affect ground water as well as the ground water itself. Board staff have been working with the airport staff and the tenants to determine the extent of pollution within these areas. A description of the subsurface investigations performed to date is outlined within Finding 6 of this Order.

### 3. REGULATORY STATUS AND DESIGNATION OF DISCHARGERS

Airport and tenant studies and investigations have found that both soil and ground water at the Site(s) have been polluted primarily by fuel constituents including oil and grease, total petroleum hydrocarbons as gasoline (TPH-g), jet fuel (TPH-j), diesel (TPH-d), benzene (B), toluene (T), xylene (X), and ethyl-benzene (E). Other constituents which have also been detected include methyl tertiary butyl ether (MTBE), naphthalene, volatile organic compounds (VOCs), tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1,2-trichloroethane (1,1,2-TCA), 1,1-dichloroethene (1,1-DCE), cis and trans 1,2 dichloroethene (1,2-DCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), vinyl chloride, methylene chloride, chloroform, n-butylbenzene, sec-butylbenzene, tert-butylbenzene, isopropylbenzene, 4-isopropyltoluene, n-propylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, acetone, 2-butenone, polychlorinated biphenyls (PCBs), benzo(a)pyrene, polynuclear aromatic hydrocarbons (PNAs) and various heavy metals including cadmium, chromium, lead, mercury, nickel, and zinc.

A subset of these chemicals have been identified as chemicals of concern (COCs) and will be regulated under this Order (See Attachment 1, Table 2). The chemicals that have been detected but are not considered as a COC were omitted because they were detected at concentrations that did not pose a risk or have been adequately remediated as part of the interim remedial work that has been performed previously. However, monitoring of some of these constituents may be required to ensure that water quality objectives are not exceeded in the future.

Due to the airport expansion project and other construction, operation and maintenance activities, many of the lease agreements and permits will be changing to accommodate the new airport facilities and as a result many of the tenants are

changing locations to meet the needs of the new airport layout. Cleanup, especially soil cleanup under the new proposed facilities and the installation of necessary soil and/or ground water treatment systems should be accomplished prior to or as part of construction activities which will be occurring over the next few years.

Orders, direction, and requirements of the Board are needed now to facilitate cleanup consistent and coordinated with the airport expansion.

a. City and County of San Francisco

Many of the Airport facilities that have contributed to pollution at the Airport are operated primarily through permits, leases and other agreements for use of the premises by tenants, permittees, and owners. The City and County of San Francisco is considered a discharger because it owns the entire airport, with the exception of the US Coast Guard plot, and has operated various facilities, such as a laboratory and a combined industrial and storm water system, that have contributed to soil and ground water pollution at the site.

b. Other Dischargers: Airline Tenants, Aviation Support Tenants, Concessions, and Governmental Agencies: (See above listing at beginning of the order)

The Airline Tenants, Aviation Support Tenants, Concessions, and Governmental Agencies are considered dischargers because their operations have caused or contributed, or threaten to cause or contribute, discharges to soil and ground water pollution at one or more of the plots at the site. In addition to their operations, the US Coast Guard is considered a Discharger because they own as well as operate the facility which has led to soil and groundwater contamination. *(See Finding 6 - Subsurface Investigations for details regarding pollution responsibility, location, source activity and type.)*

c. The City and County of San Francisco and the Tenants are hereinafter referred to as the "Dischargers".

d. The designation of who is a Discharger at a given site on the Airport may change depending upon new information supplied. In addition, the Regional Board may consider the use of "Primary Discharger" and "Secondary Discharger" where requested and found appropriate. Under Board Policy, the Executive Officer may make amendments to this Order to change Discharger status.

4. **SCOPE OF THIS ORDER:**

a. Rationale for Airport Wide Site Cleanup Requirements In order to ensure a consistent and adequate cleanup that is coordinated with airport expansion plans and other construction, operation, and maintenance activities, an airport-

wide cleanup and management strategy is appropriate. The following benefits are available utilizing an airport wide-cleanup and management strategy:

- Cleanup consistency for similar sites with similar water quality, public health, and environmental threats that can be coordinated with airport expansion plans and other construction, operation, and maintenance activities
- Streamlining of regulatory requirements and oversight for both the Dischargers and the Regional Board that could lead to a "partnership" approach
- Economies of scale for both the Dischargers and Regional Board in the areas of investigation, remediation design and implementation, monitoring, and regulation and oversight
- Level of effort and priority can match threat level for both Dischargers and Regional Board
- Encourages Tenants and the Airport to work together, especially in areas where there are commingled pollutant plumes, in the sharing of information, and in providing coordinated, consistent representation between the Regional Board and Dischargers.

This Order provides the framework to implement an airport-wide cleanup and management strategy.

- b. Airport Wide Cleanup and Management Strategy This strategy is based both on surface and ground water quality objectives and risk management considering the protection of human health and the environment, water quality in the surrounding San Francisco Bay, adjacent surface waters, and wetlands, as well as the protection of the useable ground water, especially the lower aquifer (the Westside Basin). It considers current and future land use and utilizes concepts similar to the Non-Attainment Area (NAA) policy recently (re)adopted by the Board as part of the August 1994 Basin Plan amendments.
- c. Non-Attainment Areas The Non-Attainment Area concept was developed from Regional Board and other documented nationwide agency and responsible party experiences that cleanup to background is often impracticable; that most pollution of soil and ground water is limited in extent; that dissolved phase ground water cleanup to low levels is costly compared to the benefits; that some pollutants (TPHs especially) will naturally degrade given time; and that polluted sites in limited risk areas can be managed to prevent significant risk to water quality, public health and the environment without cleanup to background. NAA provides the Regional Board and Dischargers with an acceptable cleanup management option for polluted soil and ground water cleanups for sites with limited risk. With the information available at this time, the Regional Board believes that the San Francisco International Airport and Tenants can utilize the NAA concept to manage polluted soil and ground water

cleanups. To ensure the protection of beneficial uses of useable ground water under the site and adjacent surface waters and the public health and environment, the Regional Board has required the Dischargers to develop a cleanup strategy for adequate pollutant source removal to limit further discharges of waste in addition to a residual contamination risk management plan to contain and manage the existing and/or remaining polluted soil and ground water. To document compliance, the Board is requiring, as a condition of this Order, a long term ground water monitoring program to ensure that the pollutant plume(s) is stable and is not exceeding the water quality objectives at the designated compliance monitoring points. These monitoring locations may be located at or adjacent to plume boundaries, along the preferential pathways, and at other appropriate locations as needed.

To confirm that the use of the NAA concept is appropriate and to identify risk based cleanup objectives for soil and groundwater remediation and monitoring plans, the Board adopted an Order in January (Order No. 95-018) which required the Dischargers to undertake several tasks. Under Tasks 1A and 1B, Dischargers have compiled and evaluated available data pertaining to the thickness and integrity of the bay mud beneath the airport, and have proposed additional studies to further evaluate the risk to the underlying Westside Basin across the airport using the bay mud as a protective barrier. Under Task 2, Dischargers have identified responsibility and are in the process of locating leaks within the fuel hydrant system and have proposed studies to delineate the extent of pollution. Under Task 3, Dischargers have compiled available information to calculate risk-based cleanup levels for each Remediation Management Zone (RMZ) to protect water quality, human health, and the environment.

Based upon available information, this Order establishes RMZs and Tier 1 Cleanup standards for each of the corresponding RMZs. A methodology is also provided for the development and approval by the Executive Officer of Tier 2 cleanup levels based on site specific conditions in lieu of the values used to develop the Tier 1 standards. The methodology for defining the RMZ boundaries and developing the Tier 1 standards is discussed in the following section.

To confirm assumptions made in establishing the RMZs and the Tier 1 levels, as a condition of this Order, the Dischargers are required to complete the studies proposed in Task 1B and Task 2, as outlined within Order 95-018. In addition, fate and transport studies will be required to confirm the assumptions input into the DAF model and the modeling results for the establishment of the Migration Management Zone cleanup standards. (See Provisions, Task # 3C) Additional bioassay testing will also be required to supplement and verify the TPH bioassay results conducted by United Airlines. Based upon the results of these required tasks, recommendations for modification of the RMZ boundaries

or Tier 1 cleanup levels may be requested by the Dischargers during the two year review.

For the interim time frame prior to adoption of these final RMZ cleanup levels, the Dischargers were required per Board Order 95-018 Task 4 to submit remedial action plans and schedules corresponding to the Master Plan for the Ground Transportation Center and the International Terminal, including Boarding Areas A and G.

- d. Remediation Management Zones This Order establishes five Remediation Management Zones (RMZ) for distinguishing different soil and ground water cleanup objectives appropriate to the risk to water quality, public health, and the environment based upon current information. (The zones are shown on figure 3.) For the five Remediation Management Zones identified, remediation standards for soil and groundwater are established for each RMZ based upon the risks identified within the individual zone. The zones are as follows; 1) Saltwater Ecological Protection Zone, 2) Freshwater Ecological Protection Zone, 3) Migration Management Zone 1, 4) Migration Management Zone 2, and 5) Human Health Protection Zone. A brief description of each zone is presented below. In addition to the standards for the five RMZs, standards for limiting the residual contamination to protect the Westside Basin in areas where construction activities will penetrate the bay mud layer are also established as part of this Order.

#### RMZ DESCRIPTION AND BOUNDARY DEFINITIONS

##### 1) Saltwater Ecological Protection Zone

This zone is established for the protection of saltwater flora and fauna inhabiting the Bay adjacent to the Airport as well as recreational users and fisherpersons using the Bay. This zone is defined as the area on the eastern side of the Airport adjacent to San Francisco Bay and includes the ecologically sensitive estuarine wetland areas located on the south and north sides of the airport. The zone is defined as the area between the mean high tide line depicted on the 1956, 1978, and 1979 USGS topographical map and extends inland a distance of 300 feet. (See Figure 3)

##### 2) Freshwater Ecological Protection Zone

This zone is established for the protection of freshwater flora and fauna inhabiting the ecologically sensitive freshwater wetland areas adjacent to the Airport along the western side of the Airport. It is defined as the area located along the western boundary of the Airport property and extends in a north south direction along the Bayshore Freeway. The zone begins at the outer edge of the ecologically sensitive areas and extends 300 feet to the east

towards the main Airport property. In addition, several smaller areas that have been defined as having standing freshwater within the main Airport property fall into this classification. These areas are surrounded by zones having a width of 300 feet. (See Figure 3)

### 3) Migration Management Zone 1

This zone is defined as the area immediately adjacent to both the Freshwater and Saltwater Ecological Protection Zones (SEPZ) and extends to the Migration Management Zone 2 boundary. This zone will begin at the airport side of the EPZ boundary and extends inland for a distance of 1,000 feet. (See Figure 3)

### 4) Migration Management Zone 2

This zone is defined as the remaining area within the interior of the airport bounded by the interior boundary of Migration Management Zone 1. (See Figure 3)

### 5) Human Health Protection Zone

This zone is defined as all areas that are currently occupied or may be occupied as part of the Airport's Master Plan and other planned construction and is generally defined as all non-aircraft movement areas. (See Figure 3)

### 6) Westside Basin Protection Areas

To allow for the uncertainties associated with the assumptions made in the development of the Tier 1 Standards in areas where construction of buildings and other facilities will commence prior to completion of the verification Tasks included within this Order, including Tasks 1C, 3B, 3C, and 3D, a special set of requirements will be applied within these areas to ensure protection of the drinking water aquifer underlying the airport. These areas are of particular concern for a number of reasons including: the installation of piles that will penetrate the bay mud, excavation activities associated with the installation of subgrade structures that will reduce the bay mud thickness, and the inaccessibility of the contamination once the structures have been built. Since most but not all of the areas where these types of construction activities will occur have been identified, only a narrative description can be provided for these areas at this time. These areas are defined as any area where piles are to be installed through the bay mud, any structure that will require significant excavation within the bay mud, or any activity that will lessen the capability of the bay mud to perform as a protective aquitard. These areas will be identified on a site specific basis in conjunction with Airport and Board staff.

## RMZ DESIGNATION

Designation of RMZs is based on information that was compiled during previous site investigations activities, and information presented in studies completed as part of the Board's January 18, 1995 Order, including Task 1A and Task 3. Factors used in defining the various zones included:

- Task 1A and Task 1B: As required by Board Order 95-018, an evaluation of existing information pertaining to the Bay Mud was performed. Based upon available data, it appeared that the bay mud layer which separates the upper water bearing zone (A-Fill Zone) is continuous across the airport and will act as a barrier which will limit the vertical migration of ground water pollution from the A-fill zone into the lower zone drinking water known as the Westside Basin. Results of this initial evaluation (Task 1A) also indicate that the bay mud is continuous throughout the facility, however additional information is necessary for areas where existing information is inadequate. Furthermore, more information is necessary regarding the hydraulic relationship between the A-fill zone and the underlying water-bearing units including the Westside Basin; vertical hydraulic gradient within the Westside Basin aquifer; water quality within the upper and lower units; and hydraulic effects of the adjacent water supply wells on the lower aquifer. This will be studied as part of the proposed Task 1B work and completion of this study is required as part of Task 1C of this Order. If the information contained within the Task 1C submittal indicate that some areas of the bay mud do not adequately prevent the threat to the Westside Basin, an additional RMZ(s) and Tier 1 cleanup standards for protection of the Westside Basin, revision of the existing RMZ boundaries and/or levels, or appropriate residual risk management plans containing additional institutional/engineering controls may be required.
- As part of the Task 3A work and other studies that have been completed at the Airport, an ecological assessment, an aquatic toxicity evaluation (performed by United Airlines at Plot 1 and Plots 4,5,and 6), and human health risk assessment were conducted. These studies included the identification of sensitive ecological areas that might be impacted due to the migration of polluted ground water. In order to evaluate the possible adverse affects to aquatic organisms which may be exposed, a series of bivalve and sea urchin development tests were performed (ASTM Method 724-89 Standard Guide for Conducting Static Toxicity Tests Starting with Embryos and Chronic Sea Urchin Fertilization Bioassay) using total petroleum hydrocarbon impacted soil. The study results indicate that low concentrations of TPH do have significant adverse affects on the developing bivalves that are representative of the species living within the San Francisco Bay. The results of these tests were evaluated to determine the  $EC_{10}$ , the concentration where no adverse affects were detected on 90% of the developing organisms. The  $EC_{10}$  value of these site-specific tests is the basis for the TPH cleanup objectives for the Ecological Protection Zones.

Additional evaluation of the EC<sub>10</sub>, the No Observed Effects Level (NOEL), and dose response curves are required as part of Task 3B to verify the results of the initial biological evaluations conducted by United Airlines. Based upon the results of these additional studies, the RMZ boundaries or Tier 1 cleanup standards may be revised. In addition, a mechanism for the development and approval of Tier 2 cleanup levels based upon site specific conditions in lieu of the default assumptions used to develop the Tier 1 levels is provided. (See Attachment 2) Further evaluation of specific organisms may be performed by the dischargers as part of a Tier 2 risk evaluation if they desire to recommend different cleanup objectives.

- Also as part of the Task 3A work and other studies that have been completed at the Airport, possible mechanisms of horizontal transport within the subsurface were evaluated. It was found that preferential pathways such as storm drain, fuel hydrant, and utility lines were the major mechanisms for polluted ground water transport within many areas of the airport. Additional studies are being required as part of this Order to verify the accuracy of the assumptions made regarding the parameters input into the model used to evaluate the transport along these identified pathways.
  - Areas of the Airport where human receptors are most likely to be present were identified considering current and future uses, including those associated with the Airport's Master Plan and other construction, operation, and maintenance activities. A human health risk assessment was performed as part of Task 3A to identify the risk to workers who may be exposed to residual soil and groundwater pollution at the Airport. Six risk exposure scenarios were evaluated including construction workers (temporary earth workers and general construction workers), maintenance workers, indoor workers, outdoor workers, and children attending daycare. Each group was examined for the possible exposure to chemical contaminants detected at the Airport and cleanup standards were developed protective of each scenario. The Tier 1 cleanup standards for the six scenarios are listed in Table 6: Human Health Protection Standards. The cleanup levels listed in this table are subject to revision based on the results of the studies required by this Order.
  - The zones depicted in Figure 3 have been developed using information available at the time Task 3A was completed. The boundaries of each zone are subject to change, as necessary, as additional data becomes available, including the data being collected as part of the Task 1C and Task 2 studies, and as necessary, to reflect changes in land use.
- e. Cleanup Levels: This Order requires that all free-phase product reasonably accessible will be removed; remaining chemical constituents of concern/product must be remediated or managed. This Order also establishes a Tier 0 cleanup standard for those dischargers who elect to remediate contamination (to "Non-

detect levels") and Tier 1 cleanup standards for soil and groundwater remediation for each of the five RMZs and Westside Basin Protection Areas. The Tier 0 level is for those dischargers who may wish not to be burdened by any consequential risk management requirements. For those using Tier 1 or Tier 2 approaches which involve implementing the NAA concept, the cleanup goals for on-site polluted soils and groundwater have been based in part on consideration of criteria outlined in the two Task 3 submittals prepared by the Dischargers pursuant to the January 18, 1995, Board Order. The clean-up levels specified for each of the defined zones are contingent upon the discharger preparing and complying with a remedial action plan and a residual contamination risk management plan to manage and monitor remaining COCs in the soil and/or groundwater, and meeting specified water quality objectives at containment monitoring points.

#### TIER 0 CLEANUP STANDARDS

Removal of contamination to Tier 0 levels. For the purpose of defining the Tier 0 levels for TPH-g,j,d, Oil and Grease, and BTEX, Tier 0 soil and groundwater cleanup are as follows:

##### SOIL

TPH - g 10 mg/kg

TPH - j,d 50 mg/kg

Oil and Grease 50 mg/kg

BTEX .005 mg/kg

##### GROUNDWATER

TPH - g, j, d 50 ppb

Oil and Grease 5 ppm

BTEX MCLs

#### TIER 1 CLEANUP STANDARDS:

The methodology used to derive the Tier 1 cleanup standards for each RMZ is presented below. The cleanup standards are listed in the Specification Section, Item 4 and Attachment 1 of this Order. The exposure scenarios and input parameters for Tier 1 Standards and DAF input parameters used to determine Tier 1 Cleanup Standards are listed on Attachment 3.

## 1. Saltwater Ecological Protection Zone

Due to the close proximity of the Airport to San Francisco Bay, and the likelihood of polluted groundwater discharging into the bay, protection of the beneficial uses of the adjacent surface water receptor is the objective of the Saltwater Ecological Protection Zone. The cleanup objectives for the soil and groundwater are such that when the groundwater reaches the bay it is protective of the beneficial uses and does not pose a significant risk to either the aquatic species or the people using the Bay. Upon examining the possible exposure risk scenarios, two major objectives were identified; 1) the protection of the aquatic and other species such that there is no acute or significant chronic toxicity affecting the species inhabiting the bay and wetlands adjacent to the Airport and 2) the protection of humans who may come in contact with or eat the organisms exposed to the contaminated water.

To evaluate the level protective of saltwater aquatic species, an extensive data search was performed for each of the chemicals of concern identified. The following applicable criteria documents were reviewed: USEPA ambient water quality criteria marine chronic criteria, California Water Quality Objectives for Saltwater Aquatic Life, San Francisco Bay Region Basin Plan's Shallow Water Effluent Limitations for Marine Water, USEPA Integrated Risk Information System (IRIS), and the National Toxics Rule. The values from each of the documents were compared and the lowest value was selected for each of the COCs. The most current information available was used when comparing values. In those instances where no chronic criteria were available, 10% of the acute value was used. These values are considered to be protective of the aquatic species.

Since adopted aquatic standards do not currently exist for total petroleum hydrocarbons (TPH), the EC<sub>10</sub> (the level at which 90% of the organisms developed normally) was calculated using the bivalve and sea urchin development tests performed by United Airlines. The EC<sub>10</sub> value is the basis for the cleanup standard for both Ecological Protection Zones and is similar to toxicity requirements adopted by the Board in other shallow water effluent discharges. To verify the results of the studies conducted, additional bioassay testing will be required as a condition of this Order.

Several possible human receptors were identified who may come into contact with the contaminated groundwater upon discharge to surface water. They include recreational users (i.e. windsurfers, swimmers, etc.), recreational fisherman, and subsistence fisherman. A risk evaluation was performed for each category of human receptors and a set of values were calculated for each of the COCs. The values calculated for each scenario were compared and the

most sensitive receptor group was identified and the lowest value was selected for each COC.

Finally, the human health levels were compared to the aquatic species levels and the limiting or lowest value was chosen for each COC. These Tier 1 standards are listed in Attachment 1, Table 2 and are considered cleanup standards for the Saltwater Ecological Protection Zone. Dischargers identified within this zone must meet the Tier 1 standards for soil and groundwater. Dischargers may perform a Tier 2 evaluation as specified in the Tier 2 methodology for the Ecological Protection Zone for consideration and approval by the Executive Officer. (See Attachment 2). Election to perform a Tier 2 evaluation must take into account the Master Plan and other construction, maintenance, and operation schedule requirements.

## 2. Freshwater Ecological Protection Zone

The objectives for this zone parallel that of the Saltwater Ecological Protection Zone in that there are two primary goals, the protection of the freshwater aquatic flora and fauna that have been identified on the western side of the Airport as well as people who may come in contact with the groundwater when discharged into the receiving surface water. The same approach was applied for the Freshwater Ecological Protection Zone as the Saltwater Ecological Protection Zone, except in place of the US EPA Marine Chronic Criteria, the US EPA Freshwater Chronic Criteria, California Water Quality Objectives, and the San Francisco Bay Region Basin Plan's Shallow Water Quality Effluent Limitations for Freshwater were used. Again, the same procedure was applied. The values for each COC that are considered protective of the aquatic and other species inhabiting the wetland area were compared to the human health protective values. Again, the lower of the two values were selected to ensure that both objectives were met for this zone. The Tier 1 standards for soil and groundwater for this zone are listed in Attachment 1, Table 3 of this Order. Dischargers identified within this zone must meet the Tier 1 standards for soil and groundwater. Dischargers may perform a Tier 2 evaluation as specified in the Tier 2 methodology for the Ecological Protection Zone for consideration and approval by the Executive Officer. (See Attachment 2). Election to perform a Tier 2 evaluation must take into account the Master Plan and other construction, maintenance, and operation schedule requirements.

## 3. Migration Management Zone 1 (MM1)

This zone is directly adjacent to the Ecological Protection Zones and is a minimum of 300 feet from any freshwater or saltwater surface water receptor. Although the area is not directly adjacent to any surface water receptor, the potential for contaminants in soil to leach into groundwater and migrate to the bay or wetland area via a preferential pathway (i.e. utility or storm drain

backfill) is still likely. Therefore, this zone was established to ensure that any residual contamination left within the zone would be protective of the objectives once it reached the Ecological Protection Zone.

In order to evaluate the level of pollution that could be managed in place, a fate and transport model was used known as the Dilution Attenuation Factor (DAF) Model. This model evaluates the concentration of leachate as it moves from the source soils a set distance through the aquifer to the potential receptor. Since the DAF is contingent upon the distance that the chemical must travel, a distance of 500 feet (one half the zone distance of 1,000 ft.) was selected to calculate the DAF value. A DAF value of seven was computed based upon available site specific geologic parameters. The DAF value was then used to calculate the maximum groundwater concentration at the source area that will not exceed the objectives once it reached the Ecological Protection Zone. The groundwater concentration was then used to calculate a soil value based upon the equilibrium partitioning of the chemical between the soil and groundwater. The USEPA Organic Leaching Model (OLM) (Federal Register 1986) was used to calculate the Tier 1 soil standards (using chemical specific solubility concentrations) which would not exceed the Tier 1 groundwater standards as computed by the DAF Model. Since there is no solubility value available for TPH mixtures, a series of TCLP leachate analyses were performed to develop a site specific partitioning coefficient ( $K_{sw}$ ). The  $K_{sw}$  values used for TPH-g and TPH-d/TPH-j are 160 and 686 respectively.

The Migration Management Zone 1 Tier 1 Standards for soil and groundwater are displayed in Attachment 1, Table 4. The Dischargers identified within this zone must meet the Tier 1 standards for soil and groundwater. Dischargers may perform a Tier 2 evaluation as specified in the Tier 2 methodology for consideration and approval by the Executive Officer. (See Attachment 2). Election to perform a Tier 2 evaluation must take into account the Master Plan and other construction, maintenance, and operation schedule requirements.

#### 4. Migration Management Zone 2 (MM2)

This zone is directly adjacent to Migration Management Zone 1 and is a minimum of 1,300 feet from any freshwater or saltwater surface water receptor and 1,000 feet away from either Ecological Protection Zone. Again the same approach was utilized as was for Migration Management Zone 1 for calculating the acceptable concentrations of soil and groundwater contamination that could be left within the zone which would not cause an adverse impact to the nearby surface water receptors or exceed the Migration Management Zone 1 Standards. Since a DAF value of seven was calculated for MM1 which accounted for the pollution migrating a distance of 500 feet, and this zone is an additional 500 feet away, a DAF of seven was applied to the MM 1 Tier 1 Standards to compute the MM 2 Tier 1 groundwater

standards. Again, the USEPA Organic Leaching Model was used to obtain the Tier 1 soil standards for this zone.

The Migration Management Zone 2 Tier 1 Standards for soil and groundwater are displayed in Attachment 1, Table 5. The Dischargers identified within this zone must meet the Tier 1 standards for soil and groundwater. Dischargers may perform a Tier 2 evaluation as specified in the Tier 2 methodology for consideration and approval by the Executive Officer. (See Attachment 2). Election to perform a Tier 2 evaluation must take into account the Master Plan and other construction, maintenance, and operation schedule requirements.

#### 5. Human Health Protection Zone (HH)

The objective for the Human Health Protection Zone is to identify areas within the Airport that are occupied by Airport personnel and others and to establish cleanup objectives protective of the individuals identified. (See Finding 4d for zone description). A variety of human receptors were identified who may come in contact with either the residual contaminated soil and/or groundwater. These groups include Airport employees, construction workers, and children attending daycare. These were divided into six basic categories based upon possible exposure scenarios. They include the following: indoor worker, outdoor worker, maintenance workers, temporary earth workers, general construction workers, and daycare children. A risk evaluation (risk assessment) of exposure pathways for each scenario was performed to determine a Tier 1 cleanup standard protective of the human group identified. The Tier 1 soil and groundwater standards are listed in Attachment 1, Table 6: Human Health Protection Zone Standards for each of the six scenarios. The selection of Tier 1 standards will be based on the scenario with the most stringent level chosen from only those exposure scenarios which are applicable within the Discharger's area. The Dischargers identified within this zone must meet the standards in Attachment 1, Table 6 for soil and groundwater. Dischargers may perform a Tier 2 evaluation as specified in the Tier 2 methodology for the Human Health Protection Zone for consideration and approval by the Executive Officer. (See Attachment 2). Election to perform a Tier 2 evaluation must take into account the Master Plan and other construction, maintenance, and operation schedule requirements.

#### 6. Westside Basin Protection Areas

To allow for the uncertainties associated with the assumptions made in the development of the Tier 1 Standards in areas where construction of buildings and other facilities will commence prior to completion of the verification Tasks included within this Order, including Tasks 1C, 3B, 3C, and 3D, a special set of requirements will be applied within these areas to ensure that cleanup activities undertaken are adequate to protect the drinking water aquifer underlying the

airport. These areas are of particular concern for a number of reasons including: the installation of piles that will penetrate the bay mud, excavation activities associated with the installation of subgrade structures that will reduce the bay mud thickness, and the inaccessibility of the contamination once the structures have been built. Since most, but not all, of the areas where these types of construction activities will occur have been identified, only a narrative description is provided for these areas. (See Finding 4d, Zone Boundary Definitions) Due to the threat of vertical migration associated with dense phase non-aqueous phase chlorinated hydrocarbons (DNAPL) from the A-Fill groundwater to the underlying drinking water zones, a maximum of concentration of 0.1% of the effective solubility for each of the following COCs will be allowed within these areas. The COCs include, tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1,2-trichloroethane (1,1,2-TCA), 1,1-dichloroethene (1,1-DCE), cis and trans 1-2 dichloroethene (1,2-DCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), vinyl chloride, methylene chloride, and chloroform. These values will be applied on a site specific basis considering the construction activities and bay mud thickness within each specific plot.

#### APPLICATION OF STANDARDS:

When more than one cleanup level is applicable for a particular constituent or contamination due to multiple receptor scenarios, the Discharger will be required to satisfy the most stringent level. The Discharger will also be required to prepare and comply with a plan for source removal and a residual risk management plan for containment, management, and monitoring of existing and/or remaining polluted soil and groundwater that is consistent with current and projected land and water uses. The residual contamination risk management plan should include an assessment of the residual risks to human health, water quality and the environment and measures to manage the risks (e.g., site operation, maintenance, construction and health and safety plans, worker notices, and other necessary agreements with the Airport or other affected parties needed to implement the plans, etc.), monitoring requirements and contingency options if the monitoring standards are not met. The receptor scenarios and remediation and residual risk management plans must be approved by the Executive Officer.

Tier 2 Evaluation : In the event it is proposed by the Discharger that the Tier 1 standards are not applicable to a given site for reasons that may include site specific conditions such as: unique conditions relating to contaminant types, levels and/or extent; unique conditions relating to human or ecological receptors; subsurface conditions unique to the site such as insufficient thickness of the Bay Mud; changes in current or future land-use scenarios, that necessitate application of alternate standards; etc, then the discharger may request to determine site specific clean-up standards through the application of

a Tier 2 risk assessment methodology. The Discharger shall prepare a description of the methods by which they shall determine Tier 2 cleanup levels for their site. A copy of the Discharger's proposal shall be sent to the Executive Officer for review and approval. At the same time the proposal is submitted to the Executive Officer, a copy of the proposal shall also be sent to the Airport's staff and the adjacent tenants or potentially affected parties. Comments on the proposed Tier 2 analysis shall be submitted to the Executive Officer and to the Discharger within 30 days. The resulting Tier 2 evaluation and cleanup standards must be approved by the Executive Officer prior to implementation. Attachment 2 outlines the general procedures to be employed for the Tier 2 analysis.

Dischargers will remain responsible for any future source removal, containment, management and monitoring of existing and/or remaining polluted soil and groundwater that may be required as a result of changes in land use, applicable requirements or new information.

In addition, a long term airport wide monitoring program (surface, ground water, sediment) will be required as part of this Order to determine compliance with the non attainment containment monitoring points as well as when to implement contingency measures to assure that the containment monitoring points are not violated. An airport wide monitoring network for both interior and along the airport boundary is required under Task 6 of this Order. The monitoring program will focus on the preferential pathways including but not limited to utility and storm drain conduits.

- f. Subsequent Order(s) This order will be followed by subsequent Order(s) which will revise, as necessary, the boundaries of the Human Health, Ecological, and Migration Management Zones, as well as revise any of the associated cleanup standards specified for Tier 1. Revisions or modifications to the RMZ boundaries and associated cleanup standards may be made by the Executive Officer. Board staff anticipate that the subsequent Order or revision of this Order will occur in approximately a two year period or may occur sooner at Discharger's request or as necessary to reflect the results of the Task 1C or other required studies.
- g. Discharger Compliance and Regional Board Enforcement If the Dischargers satisfactorily implement, maintain, and comply with a Regional Board approved site cleanup and management plan that incorporates the non attainment area concept, the Regional Board, utilizing its discretionary authority, will not enforce the requirement to meet water quality objectives within the approved non attainment areas. The Regional Board will enforce the requirement to meet all applicable water quality objectives for ground water adjacent to the Airport (including surface water receptors) that are not within the approved non-attainment area. The Dischargers named within this Order who have not

submitted the required reports, are not relieved of their responsibility. The Board may pursue formal enforcement against those non-participating Dischargers.

5. **HYDROGEOLOGY** Many of the areas of concern within the airport are covered by asphalt which varies from one half to four feet in thickness. The asphalt is underlain by a fill material which varies in thickness (2 to 14 feet) and composition dependent upon the time of fill and areal location. The fill varies in composition from sand to a fine grained silt or clay and has a permeability which varies depending on the composition of fill material. Within the fill material, there are buried stream channels that consist of sands and gravels and manmade gravel channels due to various utility and storm drain lines. These channels, both as manmade and original stream bed deposits, are a major mechanism for ground water and pollutant transport. The fill material is underlain by bay mud which begins anywhere from 3.5 feet below ground surface (bgs) to 16 feet bgs dependent upon the thickness of the fill material. The bay mud ranges in thickness from approximately 3 to 30 feet. Based upon subsurface investigations performed to date it appears that the bay mud is contiguous across the site. However, further studies will be necessary to confirm the continuity of the bay mud layer.

The first water bearing zone, known as the A-fill zone, occurs at approximately 3.5 to 16 feet bgs at the intersection of the fill material and bay mud interface. It varies in depth and thickness depending upon of the thickness and type of fill material in the upper zone and the depth of the original bay mud prior to fill activities.

The second zone, or A-sand zone occurs below the bay mud layer. It consists of poorly sorted sands containing some discontinuous layers of silts and clays. This zone begins generally around 15 to 20 feet bgs depending upon the thickness of the overlying fill and bay mud layers and extends to depths ranging from approximately 35 to 50 feet bgs. There appears to be a clay layer approximately 3 to 4 feet thick separating the A-sand zone from the underlying B-sand zone, but this is not conclusive due to very few sample locations. The B-sand zone begins approximately 40 to 50 feet bgs and extends to approximately 140 to 155 feet bgs where bedrock is encountered.

6. **SUBSURFACE INVESTIGATIONS** Many investigations have been performed to date at the airport under contract with the Airport Commission and by many of the tenants as well in order to identify polluted areas within the airport. The following table summarizes the areas that have been investigated, the plot number, the Discharger(s) for the site indicated, the source of the pollution, and the pollutants that have been detected either in the subsurface soils or ground water. [Note: as described in Finding 3, in addition to the named Discharger(s), the City and County of San Francisco is also considered as a Discharger since they own or have operated on the property at the time of the release.] Also, the designation of Discharger may

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be modified dependent upon new information provided. (See Figure 2 for site locations as indicated by their corresponding site number.)

TABLE 1: DISCHARGER AREA DESIGNATION

SITE NO.	AREA NAME	PLOT NO.	DISCHARGER	POLLUTION SOURCE	POLLUTANT
I	Former Pan Am Facility	1	United Airlines, Ogden Allied Ground Services	USTs, Fuel Hydrant System, Operations, Spills	TPH-g, TPH-d, TPH-j, PNAs, BTEX, VOCs PCBs, Metals
II	Trans World Airlines Cargo/Freight	3	Trans World Airlines	USTs, Fuel Hydrant System	TPH-g, TPH-j, Oil & Grease, BTEX
III	National Car Rental Facility	Road 20	National Car Rental Systems, Inc.	USTs	TPH-g, BTEX
IV	Hertz Car Rental Facility	Road 20	The Hertz Corp.	USTs	TPH-g, BTEX
V	Avis Car Rental Facility	Road 20	Avis Rent-A-Car System, Inc.	USTs	TPH-g, BTEX
VI	Chevron Station	Road 20	Chevron U.S.A. Inc.	USTs	TPH-g, BTEX, Oil & Grease
VII	United Air Lines Service Center	Plots 4,5,6	United Airlines	USTs, Fuel Hydrant System, Maintenance Operations	TPH-d, TPH-j, Motor Oil, VOCs, Semi-VOCs, Metals
VIII	South Terminal	Areas A & B	Trans World Airlines, Delta Airlines, Inc., Texaco Refining and Marketing Inc.	Fuel Hydrant System	TPH-j, TPH-d, Motor Oil
IX	North Terminal	Gate 75	United Airlines, Chevron U.S.A Inc., Shell Oil Company	USTs, Fuel Hydrant System	TPH-g, TPH-j, Oil & Grease
X	United Parking Area	Lot DD	Santa Fe Pacific Pipeline Partners	Fuel Hydrant System	TPH-j

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SITE NO.	AREA NAME	PLOT NO.	DISCHARGER	POLLUTION SOURCE	POLLUTANT
XI	American Cargo Facility	Plot 9	American Airlines	USTs	TPH-g, Oil & Grease
XII	Eastern Airlines Facility	Plots 7,8, 10	City & County of San Francisco, Quantas Airways, Signature Flight Support, Chevron Corporation	USTs, Maintenance Operations, Fuel Hydrant System	TPH-g, TPH-d, TPH-j, Oil & Grease, BTEX, VOCs, Metals
XIII	American Super Bay Hanger	Plot 40	American Airlines	USTs	TPH-g
XIV	ASI Building/ FAA Hanger	Plots 41/42	City & County of San Francisco	Maintenance Operations	Metals, Chromium, TPH
XV	Former Treatment Plant	Plot 52	City & County of San Francisco	Treatment Plant Operations, Misc.	TPH-g, TPH-d, Oil & Grease, Metals
XVI	United Airlines Maintenance Operations Center		United Airlines	USTs, Maintenance Operations	TPH-g, TPH-d, TPH-j, VOCs, Metals, Waste Oils, Stoddard solvents,
XVII	U.S. Coast Guard	Taxi-C	U.S. Coast Guard	Fuel Hydrant System	TPH-j
XVIII	Federal Express	Plot 50	City & County of San Francisco, Federal Express, Chevron U.S.A. Inc., Shell Oil Company, P.S. Group, Japan Airlines	USTs, Fuel Hydrant System, Former Laboratory	TPH-g, BTEX, TPH-j, VOCs, vinyl Chloride
XIX	Bulk Tank Farm Area	North Tank Farm	Chevron U.S.A. Inc., P.S. Group, Shell Oil Company	Bulk Storage Above Ground Tanks and Related Fuel Hydrant System Piping	TPH-j

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SITE NO.	AREA NAME	PLOT NO.	DISCHARGER	POLLUTION SOURCE	POLLUTANT
XX	FAA Spill Area	Run way 28R	Federal Aviation Administration	2,000 gallon diesel spill	TPH-d
XXI	North Storm Water Retention Pond	North Pond	City & County of San Francisco	Industrial Waste Water, Spills, Misc.	TPH-g, TPH-d, TPH-j, PNAs ?, PCBs ?, BTEX, VOCs, Metals, Cyanide?, Oil
XXII	South Storm Water Holding & Oxidation Pond	South Pond	City & County of San Francisco	Industrial Waste Water, Spills, Misc.	TPH-g, TPH-d, TPH-j, PNAs ?, PCBs ?, BTEX, VOCs, Metals, Cyanide?, Oil
XXIII	Satellite II Facility	South Tank Farm	Unocal Corporation, Shell Oil Company Texaco Refining and Marketing Inc.	Industrial Waste Water, Spills, Misc.	

7. **GROUND WATER POLLUTION** The first ground water bearing zone has been polluted with various chemical constituents dependent upon the area. The pollutants detected are listed above in tabular form on a Plot by Plot basis. They include the following: petroleum hydrocarbons, benzene, toluene, xylene, ethyl-benzene, solvents, metals, PNAs, and PCBs. Free product has been documented in various locations and mainly consists of jet fuel from the fuel hydrant system and from leaking underground storage tanks.
8. **AIRPORT FUEL HYDRANT SYSTEM** This system distributes aircraft fuel from the bulk storage above ground tank farm, located at the northern section of the airport, to the terminals where the airplanes are fueled, was found to contribute significant soil and ground water pollution throughout the entire airport. Many leaks have been discovered, the most notable at Boarding Areas A and B where in excess of 3,500 gallons of free product have been recovered due to a leak in one of the subsurface valves. Many of the fueling pits, and elbows have led to significant product loss due to the high pressure (approximately 160 to 180 psi) of the fuel within the lines. In order to better assess the contribution of fuel contamination from these lines, the Dischargers as required under Task 2A of Board Order 95-018 (which is also part of this Order) have submitted workplans to investigate the entire fuel distribution system. The work is currently being performed pursuant to the workplans

and the results of the investigation will be required under Task 2B of this Order.

9. **INTERIM REMEDIAL ACTIONS** Various interim remedial measures have been performed to date including soil excavation and treatment and free product removal from ground water extraction systems at various site locations. An interim task for an expedited cleanup of the Ground Transportation Center, International Terminal, including Boarding Areas A & G, and utility relocation areas, was included as Task 4A of Order 95-018 (which is also part of this Order) to accommodate the construction schedule of the Airport's Master Plan.
10. **BASIN PLAN** The Regional Board adopted a revised Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) on December 17, 1986, and has been subsequently amended. The Basin Plan was amended by the Regional Board on August 17, 1994, to include a Non-Attainment Area policy. The NAA policy has recently been incorporated into a State Water Resources Control Board's Resolution 92-49 and is currently under consideration by the State Water Resources Control Board. Although similar in concept to the Basin Plan amendments, this Order stands alone and does not depend upon the Basin Plan in the implementation of a Non-Attainment Area(s). The Basin Plan identifies beneficial uses and water quality objectives for the surface and ground waters in the region, as well as discharge prohibitions intended to protect beneficial uses.
11. **DESIGNATION OF GROUND WATER BENEFICIAL USES** The present and potential beneficial uses for ground water beneath and adjacent to the airport including the Westside Basin are designated in Section II of the Basin Plan. The shallow ground water zone underlying the site is not currently being used. The present and potential beneficial uses of the ground water under and adjacent to the facility including the Westside Basin are:
  - a. Industrial process water supply
  - b. Industrial service water supply
  - c. Surface water discharge to the San Francisco Bay
  - d. Municipal and Domestic Supply\*

\* Based upon the initial data collected at Plot 1, this beneficial use may not be applicable to most of the *shallow* ground water underlying the airport due to high total dissolved solids. Further evaluation which were required as part of Task 1B and Task 3 of the January 18, 1995 Order and are also required by this revision, will be necessary to determine whether or not this beneficial use is applicable to the shallow groundwater in the A-fill zone airport wide.

Existing and beneficial uses also include protection of surface water beneficial uses due to infiltration to the Bay and other surrounding surface waters.

The deeper aquifer underlying the shallow or fill zone is identified as the Westside Basin. This Basin is currently used as a drinking water supply. It is also currently being considered for additional municipal supply and is considered by several water agencies, including the City and the City of San Bruno to be a high priority basin for future municipal water supply development.

12. **DESIGNATION OF SURFACE WATER BENEFICIAL USES** The largest surface water body adjacent to the Site is the Lower San Francisco Bay. The existing and potential beneficial uses of Lower San Francisco Bay as identified within the Basin Plan include:

- a. Water Contact Recreation
- b. Non-Contact Water Recreation
- c. Preservation of Rare and Endangered Species
- d. Estuarine Habitat
- e. Wildlife habitat
- f. Fish spawning
- g. Saltwater Species Habitat
- h. Industrial Process Supply
- i. Navigation
- j. Ocean Commercial and Sport Fishing
- k. Fish Migration
- l. Shellfish Harvesting

In addition, the adjacent freshwater and brackish wetlands (identified in Figure 3) to the Airport provide similar existing and potential beneficial uses, primarily wildlife habitat as well as non-contact water recreation, and potentially preservation of rare and endangered species. These areas are not considered as a drinking water source.

#### STATE BOARD RESOLUTIONS

13. **STATE BOARD RESOLUTION 68-16** On October 28, 1968, the State Board adopted Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California". This policy calls for maintaining the existing high quality of State waters unless it is demonstrated that any change would be consistent with the maximum public benefit and not unreasonably affected beneficial uses. This is based on a Legislative

finding, contained in section 13000, California Water Code, which states in part that it is State policy that "waters of the State shall be regulated to attain the highest water quality which is reasonable". The cleanup standards and non-attainment area established by this Order are consistent with this policy.

14. **STATE BOARD RESOLUTION 92-49** On June 18, 1992, the State Board adopted Resolution 92-49, "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304". Resolution 92-49 was amended on April 21, 1994. This Order and the steps leading up to its adoption are consistent with Resolution 92-49.

#### **REGIONAL BOARD RESOLUTIONS**

15. **REGIONAL BOARD RESOLUTION 88-160** strongly encourages the maximum feasible reuse of extracted water from groundwater pollution remediations either by the dischargers or other public or private water users.

As part of the FS/RAP the Dischargers will evaluate the feasibility of reuse of the extracted water and submit a report with their proposal to the Board.

16. **REGIONAL BOARD RESOLUTION 89-39** "Incorporation of 'Sources of Drinking Water' Policy into the Water Quality Control Plan" was adopted on March 15, 1989. This policy defines groundwater as suitable or potentially suitable for municipal or domestic supply if it:

- a. has a total dissolved solids content of less than 3,000 mg/l, and
- b. is capable of producing sufficient water to supply a single well with at least 200 gallons per day.

Because of the high TDS detected in the groundwater underlying the Airport the beneficial use of the shallow groundwater may not be considered as a potential drinking water source as defined by this Resolution.

17. **CONDITION OF POLLUTION OR NUISANCE** The Dischargers have caused or permitted, and threaten to cause or permit, waste to be discharged or deposited where it is or probably will be discharged to waters of the State and create or threaten to create a condition of pollution or nuisance.
18. **COST REIMBURSEMENT** Pursuant to Section 13304 of the Water Code, the dischargers are hereby notified that the Board is entitled to, and may seek reimbursement for, all reasonable costs actually incurred by the Board to

investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects of thereof, or other remedial action, required by this Order.

19. **CEQA EXEMPTION** This action is an Order to enforce the laws and regulations administered by the Regional Board. This action is categorically exempt from the provisions of the CEQA pursuant to Section 15321 of Title 14 of the California Administrative Code, Enforcement Actions by Regulatory Agencies.
20. **NOTIFICATION OF ORDER AND PUBLIC HEARING** The Regional Board has notified the Dischargers, responsible parties and interested agencies and persons of its intent under California Water Code Section 13304 to prescribe Site Cleanup Requirements for the discharge and provided them with the opportunity for a public hearing and an opportunity to submit their written views and recommendations.
21. **PUBLIC MEETING** The Regional Board, in a public meeting, heard and considered all comments pertaining to the discharge.

**IT IS HEREBY ORDERED**, pursuant to Section 13304 of the California Water Code, that the Dischargers shall cleanup and abate the effects described in the above findings as follows:

**A. PROHIBITIONS**

1. The discharge of wastes or hazardous materials in a manner which will degrade water quality or adversely affect the beneficial uses of the waters of the State is prohibited.
2. Further significant migration of pollutants through subsurface transport to waters of the State is prohibited.
3. Activities associated with subsurface investigation and cleanup which will cause significant adverse migration of pollutants are prohibited.

**B. SPECIFICATIONS**

1. Investigation, Remediation, Management, and Monitoring Activities: The Dischargers shall conduct Site investigation, remediation, management and monitoring activities as needed to define the current hydrogeologic conditions, to define the lateral and vertical extent of soil pollution, to

define the lateral and vertical extent of ground water pollution on or emanating from their individual sites, remediate as may be required any soil pollution on-site, and remediate as may be required any ground water pollution on or emanating from their site(s) and to monitor and manage any remaining polluted soil and groundwater and any associated water quality, human health, or environmental risk. Should monitoring results show evidence of pollutant migration, the source of which is the Site, additional characterization and remediation may be required. The Dischargers shall prepare remediation and residual contamination risk management plans as needed, including an assessment of residual risks, measures to manage risks (e.g., health and safety plans; worker notices; etc.), monitoring plans, contingency plans if water quality standards are exceeded, and a commitment to mitigation measures such as participation in a regional groundwater monitoring and/or protection program.

2. Nuisance: The storage, handling, treatment or disposal of soil or ground water containing pollutants shall not create a nuisance as defined in Section 13050(m) of the California Water Code.
3. Westside Basin Protection: All construction activities that will penetrate or reduce the ability of the young bay mud to act as a protective barrier must be compatible with the RMZ cleanup levels. All reasonable precautions must be taken to hydraulically isolate the A-fill zone groundwater and the Westside Basin aquifer to prevent cross contamination between the two water bearing formations. In a timely manner prior to construction activities which will penetrate the young bay mud, a technical report describing the construction techniques, the potential risks associated with these activities, and any management techniques to be utilized for the protection of the Westside Basin shall be submitted to the Board for review.

The remediation and residual contamination risk management plans of the Dischargers responsible for the contamination must be compatible with any construction activities that may penetrate or reduce the ability of the young bay mud to act as a protective barrier with respect to such contamination. If a Site Remediation Plan allows residual contamination, the Discharger's residual contamination risk management plan shall assess the risk of cross contamination between the A-fill zone and the Westside Basin aquifer and include measures as needed to prevent such cross contamination (e.g., management and/or construction plans, or any

agreements with the Airport or other affected parties necessary to implement the plans, etc.).

Special groundwater standards will be applied within these areas to prevent the contamination of the Westside Basin. To limit the threat of vertical migration of dense phase non-aqueous phase chlorinated hydrocarbons (DNAPL) from the A-Fill groundwater to the underlying drinking water zones, a maximum of concentration of 0.1% of the effective solubility for each of the following COCs will be allowed within these areas. The COCs include, tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1,2-trichloroethane (1,1,2-TCA), 1,1-dichloroethene (1,1-DCE), cis and trans 1,2 dichloroethene (1,2-DCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), vinyl chloride, methylene chloride, and chloroform. These values will be applied on a site specific basis considering the construction activities and bay mud thickness within each specific plot.

4. Remediation Management Zone Soil and Ground Water Cleanup Levels  
RMZ boundaries are shown in Figure 3. For those dischargers who do not wish to be burdened with the consequential risk management requirements, Tier 0 is an option as described in Finding 4e. Otherwise, Tier 1 Cleanup standards for soil and groundwater are listed in Attachment 1 for the five Remediation Management Zones. The Dischargers must remediate the contaminants within their designated areas to the applicable standards listed below for the RMZ(s) in which the contamination is present unless a Tier 2 evaluation is performed as outlined in Attachment 2. Before any alternative Tier 2 cleanup/management standard may be used, it must be approved the Executive Officer as provided in Attachment 2.

The Discharger shall prepare a description of the methods by which they shall determine Tier 2 cleanup levels for their site. A copy of the Discharger's proposal shall be sent to the Executive Officer for review and approval. At the same time the proposal is submitted to the Executive Officer, a copy of the proposal shall also be sent to the Airport's staff and the adjacent tenants or potentially affected parties. Comments on the proposed Tier 2 analysis shall be submitted to the Executive Officer and to the Discharger within 30 days. An accelerated review will be given to those Dischargers within the Master Plan construction areas. The proposed Tier 2 evaluation and levels must be approved by the Executive Officer prior to implementation. Attachment 2 outlines the general procedures to be employed during completion of

Tier 2. Election to perform a Tier 2 evaluation must take into account the Master Plan and other construction, maintenance, and operation schedule requirements.

In the event the soil and groundwater is located within an area where the Human Health Protection Zone overlaps either the Ecological Protection or a Migration Management Zone, the Discharger must comply with the standards for both zones in which the pollution is located for each individual constituent. The Discharger shall compare the standards for both zones for each COC and then apply the most stringent value as the cleanup standard.

For the application of the Human Health Protection Zone, the six possible exposure scenarios must be considered. The Discharger is to identify the applicable receptor scenario for their designated area, including possible offsite receptors who may be affected, and remediate to the standard listed for that particular scenario. If more than one scenario is applicable based on the Dischargers' use of the site, the Discharger shall compare the standards for all applicable exposure scenarios and apply the most stringent standard as the cleanup standard. The receptor scenario(s) selected by the Discharger must be approved by the Executive Officer after the Airports Commission and other possible affected parties has had an opportunity to comment on the proposed scenario.

The standards listed for each zone only consider the risk for each individual chemical and does not take into account cumulative risk. Therefore, if a Discharger has multiple COCs (two or more) they must sum the individual chemical risks for all COCs detected at their site. The sum for the Class A, B, and C carcinogenic chemicals must not exceed a  $10^{-4}$  risk. In addition, consistent with US EPA RAGS, the risk for non-carcinogenic chemicals may be summed for the COCs which either operate through a similar mechanism or affect the same target organ. The total sum for the non-carcinogenic COCs Hazard Index must be equal or less than one.

5. Reclamation: If ground water extraction and treatment is considered as an alternative, the feasibility of water reuse, re-injection, and disposal to the sanitary sewer must be evaluated. Based on Regional Board Resolution 88-160, the Dischargers shall optimize, with a goal of 100%, the reclamation or reuse of ground water extracted as a result of cleanup activities. The Dischargers shall not be found in violation of this Order if documented factors beyond the Dischargers' control prevent the

Dischargers from attaining this goal, provided the Dischargers have made a good faith effort to attain this goal. If reuse or re-injection is part of a proposed alternative, an application for Waste Discharge Requirements may be required. If discharge to waters of the State is part of a proposed alternative, an application for an NPDES permit must be completed and submitted, and must include the evaluation of the feasibility of the water reuse, re-injection, and disposal to the sanitary sewer.

6. Reuse of soil onsite shall meet the applicable cleanup standards as determined within Specification 4. A soil reuse plan shall be submitted as part of the remedial action plan and/or residual contamination risk management plan.

### C. PROVISIONS

1. The Dischargers shall comply with the Prohibitions and Specifications above, in accordance with the following time schedule and tasks. Note that the original tasks as required within the January 1995 Order have been included per the request of the Dischargers to ensure continuity and clarification of subsequent related tasks. The completed tasks are noted as such. For those Dischargers named within the January Order and have not participated in the completion of these tasks, this does not relieve them of their responsibilities and they are considered in violation of this Order. These parties in violation include the following: Quantus Airlines, Ogden Allied Ground Services, Signature Flight Support - San Francisco, Inc., and the Federal Aviation Administration. The Board may pursue formal enforcement actions at a later date. Also note that the tasks are not listed in chronological order but grouped together based upon related activities.

**TASK 1A:** Submit a technical report acceptable to the Executive Officer that compiles and evaluates all geological data pertaining to the thickness and integrity of the Bay Mud for a given location of which each individual is named as a Discharger.

**DUE DATE:** FEBRUARY 15, 1995 **COMPLETED** (With the exception of those Dischargers named within Provision 1 above)

Description: The technical report should include the boundaries of the study area for which the Discharger is named and a compilation of all geotechnical information available pertaining to the thickness, integrity,

permeability, etc. Board staff recommend that Dischargers form task groups for common areas and submit the information together. The information should include a map showing locations of all borings and the detailed information or boring log data for that particular boring. Cross sections or isopachs should accompany these figures along with a complete evaluation of the data. Recommendations for locations where additional data is needed and a strategy for conducting a uniform approach for collection of data shall also be included.

**TASK 1B: Submit a workplan and implementation schedule satisfactory to the Executive Officer to evaluate the risk to the Westside Basin across the entire airport area utilizing the bay mud as a barrier.**

**DUE DATE:** MARCH 7, 1995 **COMPLETED** (With the exception of those Dischargers named within Provision 1 above. The scope for Task 1C, when approved may include: additional borings to determine the thickness and lateral extent of the bay mud in areas where insufficient data is available, as determined during the Task 1A; collection and analysis of samples to determine the physical and chemical properties of the bay mud across the Airport site; and the installation, monitoring and sampling of the shallow and deep monitoring well clusters to evaluate the hydraulic relationship between the A-fill aquifer and the shallow and deep water bearing intervals within the Westside Basin.)

Description: Each Discharger or group of Dischargers shall submit a workplan for their individual area (as determined by Task 1A) to determine the risk to the underlying Westside Basin by utilizing the Bay Mud under the A-Fill Zone as a barrier. The risk should consider at least the thickness, integrity, and possible onsite activities that may alter the integrity (BART tunnel, pilings, etc) of the bay mud and may be categorized by Remediation Management Zones. Dischargers are strongly encouraged to utilize a joint approach, workplan and report. An implementation schedule including a date for the submittal of the study results must be included.

**TASK 1C: Submit a technical report acceptable to the Executive Officer which presents the results of the Task 1B: Bay Mud Study evaluating the risk to the Westside Basin and propose any necessary modifications to the Westside Basin Protection Areas and standards.**

**DUE DATE:** SEPTEMBER 1, 1995

Description: The technical report should include all the information compiled to date regarding the ability of the young bay mud layer to act as a protective barrier to isolate the contamination within the fill zone from the Westside Basin. It should include information on the groundwater gradient within the Westside Basin and any hydraulic connection that may exist between the A-Fill and Westside Basin. The report should also include specific recommendations, as necessary for modifications or additions to the Westside Basin Protection Areas and may include recommendations for changes in the Westside Basin Protection Area boundaries, standards, and COCs. Furthermore, a recommendation must be included for any additional data deemed necessary to complete the evaluation for protection of the lower aquifer.

**TASK 2A:** Submit a workplan satisfactory to the Executive Officer identifying discharger responsibility, location of leaks within the fuel hydrant system, a delineation of the extent of pollution for those areas, and a remediation plan with schedule either airport wide, by individual site, or by Remediation Management Zone.

**DUE DATE:** FEBRUARY 15, 1995 COMPLETED (With the exception of those Dischargers named within Provision 1 above)

Description: The Technical Report (workplan) shall determine the current ownership/responsible parties of the fuel hydrant system for the entire airport. Based upon this determination, the responsible Discharger or group of Dischargers will be responsible for submitting a workplan to determine the integrity of the section of pipeline that they own and the extent of the pollution, if any, emanating from the leaking pipeline and hydrant system. The workplan should include investigation at hydrant pits, elbows, fittings, abandoned lines, and any other area that may be potential candidate for leaking (or determined to be leaking as a result of a line integrity test) hydrocarbons into the surrounding soils and ground water. The final product shall include a proposed cleanup plan with time schedule. A joint and/or master workplan airport wide or by Remediation Management Zone for all the responsible dischargers is strongly encouraged. An Implementation schedule including a date for the submittal of the study results must be included.

**TASK 2B:** Submit a report acceptable to the Executive Officer presenting the results of the Tasks 2A Fuel Hydrant System evaluation as originally required under Board Order 95-018.

**DUE DATE:** August 1, 1995 (for areas impacted by the construction upcoming activities)

October 1, 1995 (for all other non-construction areas)

Description: For the areas impacted by the upcoming Master Plan construction schedule (including the Ground Transportation Center, the new International Terminal, Boarding Areas A & G, and the Utility Trench at Plot 50) the results of the Task 2A work shall be submitted by August 1, 1995. For all other non-critical construction areas, the results shall be submitted by October 1, 1995. The report must include the results of the field investigation for the delineation of contamination originating from the fuel distribution system. It must include all sample locations and sample results including any previous sample data. Each Discharger is responsible for the segment of pipeline as designated within the Task 2 - Fuel System Workplan submitted on behalf the responsible Dischargers (Consolidated Tenant Group). Recommendation for any additional characterization must be included.

**TASK 3A:** Submit a technical report satisfactory to the Executive Officer recommending appropriate and applicable cleanup objectives and an implementation schedule for all constituents for soil and ground water within each Remediation Management Zone.

**DUE DATE:** APRIL 15, 1995 COMPLETED (See Supplemental Attachment 3 for exposure scenarios and input parameters used to calculate the Tier 1 Standards)

Description: The Dischargers which have detected particular constituents of concern within their designated areas shall submit a technical report satisfactory to the Executive Officer which details an approach for setting cleanup objectives. This report should include and incorporate the results of both Task 1A and Task 1B (the evaluation of the integrity of the Bay Mud study). Recommendations of numerical cleanup objectives for both soil and ground water to protect water quality, human health, and the environment for both fuel and non-fuel constituents for each Remediation Management Zone shall be included. The approach should utilize risk based techniques for assessing exposure

to water quality, human and ecological receptors. The implementation schedule shall be coordinated with the Airport expansion plans such that polluted soil removal or remediation is completed at polluted sites before or during demolition and as a minimum prior to new building construction or occupancy. Dischargers are strongly encouraged to prepare and submit a joint technical report.

**TASK 3B: Submit a workplan acceptable to the Executive Officer for the Evaluation of the affects of Total Petroleum Hydrocarbons on aquatic organisms.**

**DUE DATE:     OCTOBER 1, 1995**

Description: Submit a workplan outlining the additional biological testing to be performed to evaluate the effects of Total Petroleum Hydrocarbons on aquatic organisms. The evaluation should include TPH-g, TPH-d, TPH-j, and oil and grease fractions of TPH. The workplan must include a testing methodology, the specific organisms to be tested, and a process for evaluating the test results.

**TASK 3C: Submit a workplan acceptable to the Executive Officer for a fate and transport study evaluating the movement of contamination throughout the airport property.**

**DUE DATE:     NOVEMBER 1, 1995**

Description: The workplan must evaluate the transport of contaminants from the soil into the groundwater in order to verify the equilibrium partitioning values for soil and water. It must also examine the DAF values for RMZs MM1 and MM2 and verify the assumptions used to calculate the values used. The workplan must specify the field testing to be performed and the methodology to be used to correlate between the field data and the DAF values used. This workplan may be coordinated with the airport wide groundwater monitoring plan as required in Task 6.

**TASK 3D: Submit a technical report acceptable to the Executive Officer verifying and proposing modifications to the RMZ zones and standards as appropriate considering the results of Tasks 1B, 2, 3B, and 3C..**

**DUE DATE:     JULY 1, 1997**

Description: The report may include specific recommendations for modifications to the RMZs and may include changes in zone boundaries, changes in Tier 1 cleanup standards, addition or deletion of COCs, or receptor scenarios. Any recommendations must have supporting rationale and documentation in order to be considered.

**TASK 3E: Submit a technical report acceptable to the Executive Officer describing the sensitive ecological habitat areas within the airport property based on existing studies.**

**DUE DATE: August 1, 1995**

Description: The City and County of San Francisco Airports Commission shall submit a report describing all sensitive ecological habitat that has been identified within the Airport proper and adjacent areas in which they own or impact. In addition, all areas that are scheduled for modifications associated with storm water facility improvements including those to be concrete lined must be identified. This task is necessary to better define the ecological protection zones within the airport to ensure adequate protection of these sensitive habitat areas.

**TASK 4: Submit a technical report acceptable to the Executive Officer for the interim time frame prior to the adoption of the final RMZ cleanup objectives for the remediation of the Ground Transportation Center Area and New International Terminal Area.**

**DUE DATE: JUNE 1, 1995 PARTIALLY COMPLETED**

(Submit proposed implementation schedule: **March 16, 1995.**)

Description: All Dischargers located within the Ground Transportation Center area and proposed International Terminal area shall submit individual or a combined workplan acceptable to the Executive Officer for the remediation/management of contaminated soils and groundwater. The plan should include an implementation schedule which corresponds to the Airport Master Plan, selection of remedial option, confirmation sampling and analyses plan, disposal plan for contaminated/treated soils, a groundwater treatment plan for both dewatering during excavation activities and long term, and a groundwater quarterly monitoring plan. Staff are aware that the final design specifications are forthcoming and therefore will allow for flexibility on the implementation of the remedial

action plan. Any remedial action plan required by this task shall include a risk management plan as described in the findings and specifications.

**TASK 5: Submit a Feasibility Study/Remedial Action Plan acceptable to the Executive Officer outlining remedial actions to be performed to comply with the RMZ Standards.**

**DUE DATE: JANUARY 15, 1996**

Description: Each Discharger (except those located within the construction areas as identified within Task 4) shall submit a Feasibility Study outlining the various actions that can be performed to meet the standard(s) for the zone(s) in which they are located. A remedial action alternative must be selected and a workplan developed for the selected alternative. The RAP must identify the applicable standards or include a workplan with time schedule to conduct a Tier 2 analysis pursuant to Attachment 2. A confirmation sampling plan documenting compliance with the RMZ objectives is required as well as a residual contamination risk management plan. A compliance groundwater monitoring plan will also be required if residual levels of pollution is in excess of the zone standards are left in place. An implementation schedule must be included. Any remedial action plan required by this task shall include a risk management plan as described in the findings and specifications.

**TASK 6: Submit a report acceptable to the Executive Officer for a compliance groundwater monitoring plan.**

**DUE DATE: SEPTEMBER 1, 1995, for the airport-wide plan  
and on or before submission of the Remedial Action Plan  
for individual Discharger sites.**

Description: A comprehensive Airport-wide and plume/site-specific groundwater monitoring programs shall be required to document compliance with the provisions of this Order. The Dischargers shall submit to the Regional Board a workplan acceptable to the Executive Officer setting a groundwater monitoring plan. The groundwater monitoring plan shall will include monitoring of the Airport-wide groundwater monitoring wells and plume/site groundwater monitoring wells. The Board may allow flexibility based upon site specific conditions. The Airport-wide monitoring plan shall include shallow A-zone wells and the deeper Westside Basin wells located throughout the

Airport. Installation and monitoring of some of the Westside Basin wells and some of the shallow A-Fill Zone wells is presently included within the required scope of Task 1C of Order No. 95-018 (which is part of this Order). The Airport-wide monitoring plan shall be designed to monitor groundwater quality and movement within the Human Health, Ecological, and Migration Management Zones. Individual Dischargers shall submit a workplan for their plume/site monitoring. The individual Discharger monitoring plan shall include on-site shallow A-zone wells, defining the extent and concentration of contaminants within specific plumes, and the Westside Basin wells, if required, based on the types and concentration of contaminants present. The groundwater monitoring plan should identify all monitoring well locations including any new monitoring well locations needed to document compliance with the RMZ standards. They must include all areas identified in Task 1C where the risk to the Westside Basin has been identified. Monitoring within the preferential pathways must be included, as well as any criteria for addition or deletion of monitoring locations. The plume/site monitoring network will be designed to be protective of the Human Health, Ecological, and Migration Management zones, and confirm the reduction of contaminants within the plume, the limits of the plume, and groundwater flow direction and magnitude.

Responsibility for installation, monitoring, and reporting of results for the wells included within the Airport- wide network shall be borne by all named Dischargers. Responsibility for installation and monitoring of the site/plume specific well networks shall be borne by the responsible Discharger.

2. The Dischargers shall submit to the Regional Board reports acceptable to the Executive Officer on compliance with the requirements of this Order and monitoring reports that contain descriptions and results of work and analysis performed. These reports are to be submitted according to a program prescribed as outlined below.
  - a. **ON A QUARTERLY BASIS**, the Dischargers shall submit status reports, which may be prepared in a business letter format, documenting compliance with this Order commencing on **July 15, 1995**. Thereafter, reports shall be due **quarterly** on the 15th of each ensuing July, October, January, and April. These reports may be submitted separately, but it is strongly encouraged that the reports be submitted in combination with other Dischargers and/or

other report due. Each quarterly report shall cover the previous calendar quarter and include at least the following information:

- (1) Summary of the work completed since submittal of the previous report, and work projected to be completed before the submittal of the next report.
- (2) Identification of any obstacles which may threaten compliance with the schedule set forth by this Order, and what actions are being taken to overcome these obstacles.
- (3) This report may be combined with the quarterly monitoring report as outlined below. The Board strongly encourages consolidated reports between multiple Dischargers.

b. **ADDITIONALLY, ON A QUARTERLY BASIS**, technical reports documenting quarterly ground water monitoring shall be submitted by the Dischargers to the Regional Board commencing **July 15, 1995**, and covering the previous calendar quarter. In order to facilitate Airport wide consistency, water level measurements and samples of all monitoring wells shall be collected the first week of the month prior to the month of submittal. Each quarterly monitoring report shall include, but not be limited to, the following information:

- (1) Cumulative tabulated results of free product measurements for total petroleum hydrocarbons and water quality sampling analyses for all monitoring wells both on and related off-Site. This data shall be accompanied by pollutant isoconcentration plume maps for each chemical constituent of concern for the first water bearing formations based upon the results of the recent sampling event.
- (2) A cumulative tabulation of all well construction details including screen intervals, screen lengths, well installation dates, quarterly water level measurements, and cumulative chemical concentrations for each well.
- (3) Quarterly updated water table and piezometric surface maps, based upon the most recent water level measurements for all affected water bearing zones for all on-Site and related off-Site wells.

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- (4) A cumulative tabulation of volume of extracted ground water, quarterly chemical analyses results for all extraction wells, and a report indicating the pounds of pollutants removed during the quarter and total pounds of pollutants removed to date.
  - (5) Reference diagrams and maps including the hydrogeologic conditions of the Site, and appropriately scaled and detailed base maps showing the location of all monitoring wells and extraction wells, and identifying facilities and structures.
- c. **ON AN ANNUAL BASIS**, technical reports on the progress of compliance with all requirements of this Order and any proposed modifications which could increase the effectiveness of final cleanup actions shall be submitted to the Regional Board by the Dischargers. The first annual compliance report is due **January 15, 1996**, and would cover the previous calendar years activities. Annual reports may combine quarterly reports due concurrently. The annual progress reports shall include, but not necessarily be limited to, progress on site investigation and remediation activities, operation and implementation of interim and final remediation systems, effectiveness of remediation actions and systems, and an evaluation of the feasibility of meeting the ground water and soil cleanup standards established by this Order.

With appropriate justification and written request from the dischargers, the Executive Officer may amend the reporting requirements for content and frequency.

- 3. The dischargers may, by written request, seek modifications or revisions, or termination of this Order or any program, plan, or schedule submitted pursuant to this Order at any time. This Order and any applicable program, plan, or schedule may be modified, terminated, or revised by the Regional Board or the Executive Officer.
- 4. If the Dischargers are delayed, interrupted or prevented from meeting one or more of the completion dates specified in this Order, the Dischargers shall promptly notify the Executive Officer. If, for any reason, the Dischargers are unable to perform any activity or submit any document within the time required under this Order, the Dischargers may make a written request for a specified extension of time. The extension request shall include justification for the delay, and shall be submitted to the Regional Board in advance of the date on which the activity is to be

performed or the document is due. The Regional Board staff may propose an amendment to the Order and bring the matter to the Board for consideration.

5. All hydrogeological plans, specifications, technical reports and documents shall be signed by or stamped with the seal of a State registered geologist, registered civil engineer, or certified engineering geologist.
6. All samples shall be analyzed by a State certified laboratory or laboratory accepted by the Regional Board using approved EPA methods for the type of analysis to be performed. All laboratories or the consultant shall be required to maintain quality assurance/quality control records for Regional Board review.
7. The Dischargers shall maintain in good working order, and operate in the normal standard of care, any facility or control system installed to achieve compliance with the requirements of this Order.
8. Copies of all correspondence, reports, and documents pertaining to compliance with the Prohibitions, Specifications, and Provisions of this Order shall also be provided to the following agencies:
  - a. San Mateo County Health Department (Attn: Ms. Gail Lee)
  - b. San Francisco International Airports Commission (Attn: Mr. Sam Mehta)
9. The Dischargers shall permit, within the scope of each of their authorities, the Regional Board or its authorized representative, in accordance with Section 13267 (c) of the California Water Code:
  - a. Entry upon dischargers' premises in which any pollution sources exist, or are suspected to exist, or inspection of any required records, which are relevant to this Order.
  - b. Access to copy any records required to be kept under the terms or conditions of this Order.
  - c. Inspection of any monitoring equipment or methodology implemented in response to this Order.

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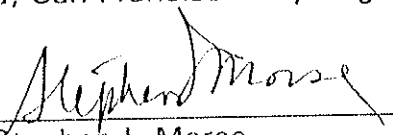
- d. Sampling of any ground water or soil which is accessible, or may become accessible, as part of any investigation or remedial action program undertaken by the Discharger.
10. To the extent a Discharger has any ownership or present possessory interest in or to the Site, such Discharger shall file a report in a timely manner on any changes in Site occupancy and ownership associated with the facility/property described in this Order.
11. If in performing any work pursuant to this Order, any hazardous substance is discharged in or on any waters of the State, or discharged and deposited where it is, or probably will be discharged in or on any waters of the State, the Dischargers shall report such a discharge to this Board, at (510) 286-1255 on weekdays during office hours from 8:00 a.m. to 5:00 p.m., and the Office of Emergency Services at (800) 852-7550 during non-office hours. A written report shall be filed with the Board within five (5) working days and shall contain information relative to: the nature of the waste or pollutant, quantity involved, duration of incident, cause of spill, Spill Prevention, Control and Countermeasure Plan in effect, if any, estimated size of affected area, nature of effects, corrective measures that have been taken or planned, and a schedule of these activities, and persons notified.
12. This Order is intended to be the primary regulating document by which Site cleanup shall proceed for the Dischargers and properties identified herein with the Regional Board as lead agency. This Order revises Order 95-018. The Dischargers shall establish a primary contact representing the named Discharger(s) and submit the name of that representative to the Regional Board.
13. If the Executive Officer finds that the Discharger(s) have failed to comply with the Provisions of this Order, he is authorized to issue a complaint for Board consideration of Administrative Civil Liabilities, or after approval of the Board Chairperson, to request the Attorney General to take appropriate action against the Discharger(s), including injunctive and civil remedies, if appropriate.
14. The Dischargers shall be liable, pursuant to Section 13304 of the California Water Code, to the Board for all reasonable costs actually incurred by the Board to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial actions, required by this Order. All sites regulated

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under the Above-Ground Petroleum Storage Tank (AGT) program will continue to reimburse pursuant to the AGT program. If the Dischargers addressed by this Order are enrolled in a State Board-managed reimbursement program, reimbursement shall be made pursuant to this Order and according to procedures established in that program. Any disputes raised by discharger(s) over the reimbursement amounts or methods used in that program shall be consistent with the dispute resolution procedures of that program.

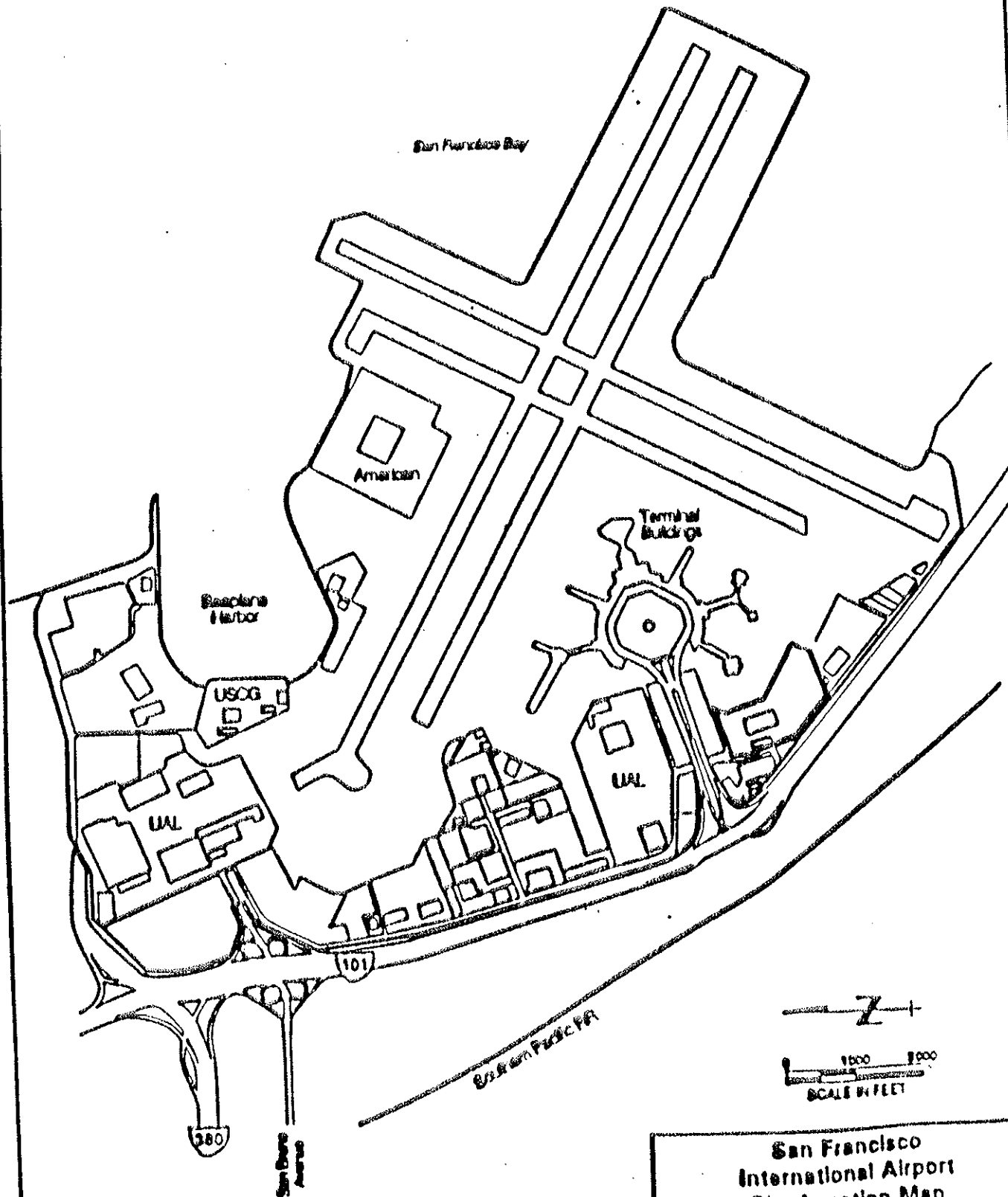
15. The Regional Board will review this Order periodically and may revise the requirements when necessary.

I, Stephen I. Morse, as acting Executive Officer, do hereby certify that the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on June 21, 1995.

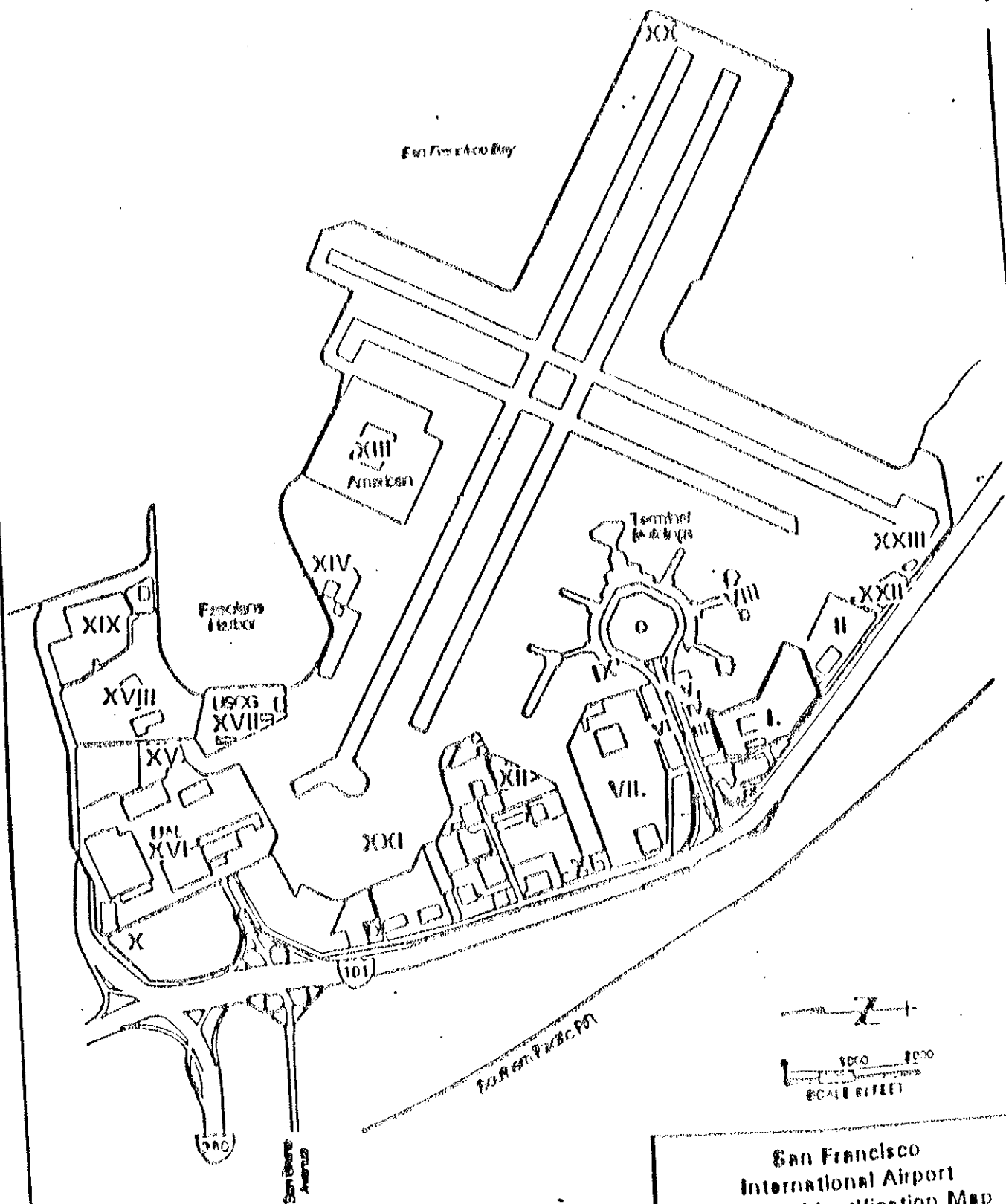
  
\_\_\_\_\_  
Stephen I. Morse  
Acting Executive Officer

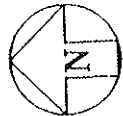
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Figures: #1 Site Location Map; #2 Site/Plot Identification Map; #3 Remediation Management Zone Map  
Attachment 1: Remediation Management Zone Tier 1 Standards  
Attachment 2: Tier 2 Methodology  
Attachment 3: Exposure Scenarios and Input Parameters for Tier 1 Standards and DAF Input Parameters



San Francisco  
International Airport  
Site Location Map  
FIGURE 1





LEGEND



ZONE 1: HUMAN HEALTH RISK  
MANAGEMENT ZONE



MARINE WATER ECOLOGICAL  
PROTECTION ZONE



FRESH WATER ECOLOGICAL  
PROTECTION ZONE



MIGRATION MANAGEMENT ZONE BOUNDARIES



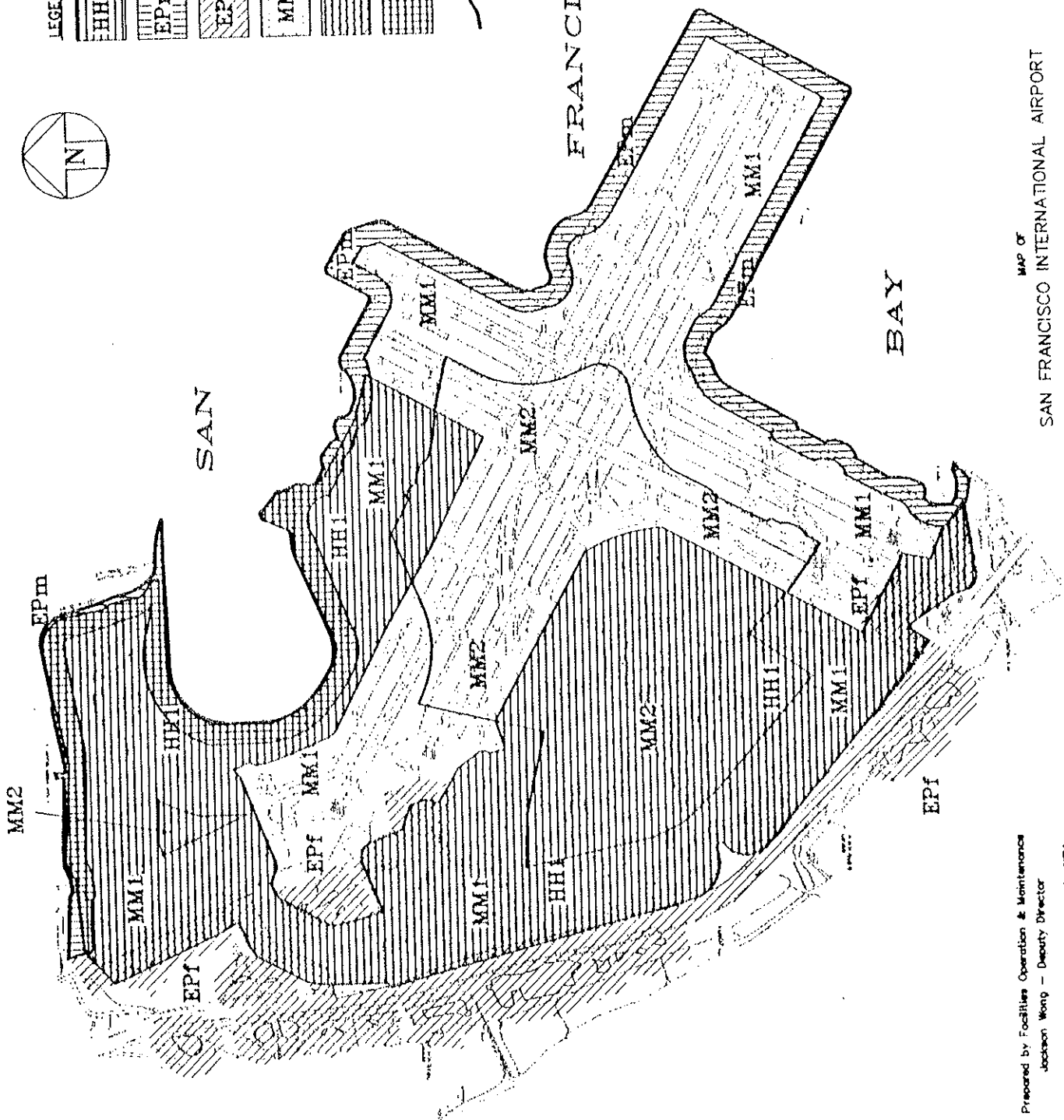
OVERLAP OF HUMAN HEALTH RISK  
MANAGEMENT ZONE & FRESH WATER  
ECOLOGICAL PROTECTION ZONE



OVERLAP OF HUMAN HEALTH RISK  
MANAGEMENT ZONE & MARINE WATER  
ECOLOGICAL PROTECTION ZONE



SHORELINE AS DEPICTED ON 1964,  
1976 & 1979 U.S.C.S. MAPS



RISK BASED REMEDIATION  
MANAGEMENT ZONES

RWOCB CLEANUP ORDER  
TASK 3

SAN FRANCISCO INTERNATIONAL AIRPORT

Figure 3  
May 1995

MAP OF  
SAN FRANCISCO INTERNATIONAL AIRPORT

Prepared by Facilities Operation & Maintenance  
Jackson Wong - Deputy Director





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## **Attachment 1**

### **Remediation Management Zone Tier 1 Standards**

TABLE 2: SALTWATER ECOLOGICAL PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
1. Benzene (B)	2.7	71	Water: Basin Plan Shallow Water Effluent Soil: USEPA OLM Model
2. Benzo(a)pyrene	0.04	0.031	Water: Basin Plan Shallow Water Effluent Soil: USEPA OLM Model
3. Chloroform	17	470	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
4. 1,1-Dichloroethane (1,1-DCA)	2.3	99	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
5. 1,2-Dichloroethane (1,2-DCA)	1.8	99	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
6. 1,1-Dichloroethene (1,1-DCE)	0.09	3.2	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
7. 1,2-Dichloroethene (1,2-DCE)	0.02	3.2	Water: Based Upon USEPA Water Quality Criteria for 1,1-DCE Soil: USEPA OLM Model
8. Ethylbenzene (E)	5	43	Water: 10% US EPA Marine Accute Criteria Soil: USEPA OLM Model
9. Methylene Chloride (MC)	42	1,060	Water: Protection Subsistence Fisherman Soil: USEPA OLM Model
10. Methyl Tertiary Butyl Ether (MTBE)	-----	-----	Monitoring Only

TABLE 2: SALTWATER ECOLOGICAL PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
11. Naphthalene	41	100	Water: Based on TPH-j EC10 Soil: USEPA OLM Model
12. Oil & Grease (TOG)	-----	-----	Site Specific Value to be Recommended by Discharger for Executive Officer approval
13. Poly-Aromatic Hydrocarbons (Total PNAs)	0.04	0.031	Water: USEPA Water Quality Criteria Soil: USEPA OLM Model
14. Poly-chlorinated Biphenols/Aroclor (Total PCBs)	$8 \times 10^{-7}$	0.000045	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
15. Tetrachloroethylene (PCE)	0.3	6.9	Water: California water quality objective Soil: USEPA OLM Model
16. Toluene (T)	2,700	5,000	Water: US EPA marine chronic criteria Soil: USEPA OLM Model
17. Total Petroleum Hydrocarbons as Gasoline (TPH-g) <sup>4</sup>	16	100	Water: EC <sub>10</sub> -bivalves and sea urchin bioassay Soil: K <sub>sw</sub> = 160
18. Total Petroleum Hydrocarbons as Jet Fuel (TPH-j) <sup>4</sup>	68	100	Water: EC <sub>10</sub> -bivalves and sea urchin bioassay Soil: K <sub>sw</sub> = 686
19. Total Petroleum Hydrocarbons as Diesel (TPH-d) <sup>4</sup>	68	100	Water: EC <sub>10</sub> -bivalves and sea urchin bioassay Soil: K <sub>sw</sub> = 686
20. 1,1,2-Trichloroethane (1,2-TCA)	0.7	42	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model

TABLE 2: SALTWATER ECOLOGICAL PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
21. Trichloroethylene (TCE)	4.3	81	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
22. Vinyl Chloride (VC)	0.4	17	Water: Protection Subsistence Fisherman Soil: USEPA OLM Model
23. Xylene (X)	>Saturation <sup>1</sup> =990 (1,440)	2,200	Water: US EPA Water Quality Criteria Soil: =Saturation concentration
INORGANICS	mg/kg	µg/L	
24. Cadmium	See Foot Note #3	9.3	Water: US EPA Marine Chronic Criteria Limit Soil: USEPA OLM Model
25. Chromium <sup>1</sup>	See Foot Note #3	50	Water: Basin Plan Shallow Water Effluent Limit Soil: USEPA OLM Model
26. Lead <sup>2</sup>	See Foot Note #3	5.6	Water: California Water Quality Criteria Limit Soil: USEPA OLM Model
27. Mercury (inorganic)	See Foot Note #3	0.025	Water: US EPA Marine Chronic Criteria Limit Soil: USEPA OLM Model
28. Nickel	See Foot Note #3	7.1	Water: Basin Plan Shallow Water Effluent Limit Soil: USEPA OLM Model
29. Zinc	See Foot Note #3	58	Water: Basin Plan Shallow Water Effluent Limit Soil: USEPA OLM Model

1. Chromium is the value for total chromium assuming all is hexavalent chromium. If dischargers opt to speciate between hexavalent and trivalent, an alternate level will be considered.
2. This concentration is for total lead. If lead is detected above the screening level for an area identified with TPH-g, then an analysis for tetra-ethyl lead shall be done.
3. Soil standards for metals will be determined on a site specific basis and must be protective of the water quality standards listed above.
4. An  $EC_{10}$  value of approximately 200 ppb was calculated for TPH for gasoline and diesel fractions. It was assumed that each made up 50 % of the mixture and therefore this concentration was divided in half to calculate Tier 1 standards for the TPH-g and TPH-d fractions. Therefore, up to twice the concentration may be used as a Tier 1 cleanup criteria if the Discharger has only TPH-g, TPH-j, or TPH-d at their particular site with approval from the Executive officer.
5. Risk based levels for the zone exceeded the saturation or solubility concentrations. Therefore, since no free product is acceptable as part of the conditions of this Order, the saturation or solubility concentration will be used as the Tier 1 standard. The risk based level calculated is shown in parenthesis within the table.

TABLE 3: FRESHWATER ECOLOGICAL PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
1. Benzene (B)	0.013	0.34	Water: Basin Plan Shallow Water Effluent Limit Soil: USEPA OLM Model
2. Benzo(a)pyrene	0.04	0.0028	Water: Basin Plan Shallow Water Effluent Limit Soil: USEPA OLM Model
3. Chloroform	17	470	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
4. 1,1-Dichloroethane (1,1-DCA)	2.3	99	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
5. 1,2-Dichloroethane (1,2-DCA)	1.8	99	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
6. 1,1-Dichloroethene (1,1-DCE)	0.09	3.2	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
7. 1,2-Dichloroethene (1,2-DCE)	0.02	3.2	Water: Based upon USEPA Water Quality Criteria for 1,1-DCE Soil: USEPA OLM Model
8. Ethylbenzene (E)	2,916	3,200	Water: 10% US EPA Freshwater Acute Criteria Soil: USEPA OLM Model

TABLE 3: FRESHWATER ECOLOGICAL PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
9. Methylene Chloride (MC)	42	1,060	Water: Protection Subsistence Fisherman Soil: USEPA OLM Model
10. Methyl Tertiary Butyl Ether (MTBE)	-----	-----	Monitoring Only - - No Standard
11. Naphthalene	41	100	Water: Based on TPH-j EC <sub>10</sub> Soil: USEPA OLM Model
12. Oil & Grease (TOG)	-----	-----	Site Specific Value to be Recommended by Discharger for Executive Officer approval
13. Poly-Aromatic Hydrocarbons (Total PNAs)	0.04	0.031	Water: USEPA Water Quality Criteria Effluent Limit Soil: USEPA OLM Model
14. Poly-chlorinated Biphenols/Aroclor (Total PCBs)	$8 \times 10^{-7}$	0.000045	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
15. Tetrachloroethylene (PCE)	0.3	6.9	Water: California Water Quality Objective Soil: USEPA OLM Model
16. Toluene (T)	573	1,750	Water: 10% US EPA Freshwater Acute criteria Soil: USEPA OLM Model
17. Total Petroleum Hydrocarbons as Gasoline (TPH-g)	16	100	Water: EC <sub>10</sub> - bivalves and sea urchin bioassay Soil: K <sub>sw</sub> = 160

TABLE 3: FRESHWATER ECOLOGICAL PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
18. Total Petroleum Hydrocarbons as Jet Fuel (TPH-j)	68	100	Water: EC <sub>10</sub> - bivalves and sea urchin bioassay Soil: K <sub>sw</sub> = 686
19. Total Petroleum Hydrocarbons as Diesel (TPH-d)	68	100	Water: EC <sub>10</sub> - bivalves and sea urchin bioassay Soil: K <sub>sw</sub> = 686
20. 1,1,2-Trichloroethane (1,2-TCA)	0.7	42	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
21. Trichloroethylene (TCE)	4.3	81	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
22. Vinyl Chloride (VC)	0.4	17	Water: Protection Subsistence Fisherman Soil: USEPA OLM Model
23. Xylene (X)	>saturation <sup>5</sup> =990 1,440	2200	Water: US EPA Water Quality Criteria Soil: USEPA OLM Model
INORGANICS	mg/kg	µg/L	
24. Cadmium	See Foot Note #3	1.1	Water: US EPA Freshwater Chronic Criteria Soil: USEPA OLM Model
25. Chromium <sup>1</sup>	See Foot Note #3	11	Water: Basin Plan Shallow Water Effluent Limit Soil: USEPA OLM Model

TABLE 3: FRESHWATER ECOLOGICAL PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
26. Lead <sup>2</sup>	See Foot Note #3	3.2	Water: California Water Quality Criteria Soil: USEPA OLM Model
27. Mercury (inorganic)	See Foot Note #3	0.012	Water: USEPA Freshwater Chronic Criteria Soil: USEPA OLM Model
28. Nickel	See Foot Note #3	160	Water: Basin Plan Shallow Water Effluent Limit Soil: USEPA OLM Model
28. Zinc	See Foot Note #3	58	Water: Basin Plan Shallow Water Effluent Limit Soil: USEPA OLM Model

1. Chromium is the value for total chromium assuming all is hexavalent chromium. If dischargers opt to speciate between hexavalent and trivalent, an alternate level will be considered.
2. This concentration is for total lead. If lead is detected above the screening level for an area identified with TPH-g, then an analysis for tetra-ethyl lead shall be done.
3. Soil standards for metals will be determined on a site specific basis and must be protective of the water quality standards listed above, using appropriate leachate analysis.
4. An EC<sub>10</sub> value of approximately 200 ppb was calculated for TPH for gasoline and diesel fractions. It was assumed that each made up 50% of the mixture and therefore this concentration was divided in half to calculate Tier 1 standards for the TPH-g, TPH-j, and TPH-d fractions. Therefore, up to twice the concentration may be used as a cleanup criteria if the Discharger has only TPH-g, TPH-j, or TPH-d at their particular site with approval of the Executive Officer.
5. Risk based levels for the zone exceeded the saturation or solubility concentrations. Therefore, since no free product is acceptable as part of the conditions of this Order, the saturation or solubility concentration will be used as the Tier 1 standard. The risk based level calculated is shown in parenthesis within the table.

TABLE 4: MIGRATION MANAGEMENT ZONE 1 TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Level	Maximum Groundwater Level	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
1. Benzene (B)	47	497	Water: DAF=7 Soil: OLM Model
2. Benzo(a)pyrene	0.6	0.2	Water: DAF=7 Soil: OLM Model
3. Chloroform	313	3290	Water: DAF=7 Soil: OLM Model
4. 1,1-Dichloroethane (1,1-DCA)	42	693	Water: DAF=7 Soil: OLM Model
5. 1,2-Dichloroethane (1,2-DCA)	33	693	Water: DAF=7 Soil: OLM Model
6. 1,1-Dichloroethene (1,1-DCE)	1.5	22	Water: DAF=7 Soil: OLM Model
7. 1,2-Dichloroethene (1,2-DCE)	0.3	22	Water: DAF=7 Soil: OLM Model
8. Ethylbenzene (E)	89	301	Water: DAF=7 Soil: OLM Model
9. Methylene Chloride	747	7420	Water: DAF=7 Soil: OLM Model
10. Methyl Tertiary Butyl Ether (MTBE)	-	-	Monitoring Only
11. Naphthalene	728	700	Water: DAF=7 Soil: OLM Model
12. Oil & Grease (TOG)	-	-	Site Specific Value to be Recommended by Discharger for Executive Officer approval
13. Poly-Aromatic Hydrocarbons (Total PNAs)	0.7	0.22	Water: DAF=7 Soil: OLM Model
14. Poly-chlorinated Biphenols/Aroclor (Total PCBs)	$1.3 \times 10^5$	0.0003	Water: DAF=7 Soil: OLM Model
15. Tetrachloroethylene (PCE)	6	48	Water: DAF=7 Soil: OLM Model
16. Toluene (T)	>saturation <sup>1</sup> =2,800 (47,630)	35,000	Water: DAF=7 Soil: Saturation Concentration

TABLE 4: MIGRATION MANAGEMENT ZONE 1 TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Level	Maximum Groundwater Level	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
17. Total Petroleum Hydrocarbons as Gasoline (TPH-g)	112	700	Water: DAF=7 Soil: $K_{sw}=160$ (Based on site specific TCLP analysis)
18. Total Petroleum Hydrocarbons as Jet Fuel (TPH-j)	480	700	Water: DAF=7 Soil: $K_{sw}=686$ (Based on site specific TCLP analysis)
19. Total Petroleum Hydrocarbons as Diesel (TPH-d)	480	700	Water: DAF=7 Soil: $K_{sw}=686$ (Based on site specific TCLP analysis)
20. 1,1,2-Trichloroethane (1,1,2-TCA)	13	294	Water: DAF=7 Soil: OLM Model
21. Trichloroethylene (TCE)	75	567	Water: DAF=7 Soil: OLM Model
22. Vinyl Chloride (VC)	7	119	Water: DAF=7 Soil: OLM Model
23. Xylene (X)	>saturation <sup>1</sup> =990 (25,410)	15,400	Water: DAF=7 Soil: Saturation Concentration
INORGANICS <sup>3</sup>	SEE FOOTNOTE #3		
24. Cadmium			
25. Chromium <sup>1</sup>			
26. Lead <sup>2</sup>			
27. Mercury (inorganic)			
28. Nickel			
28. Zinc			

1. Chromium is the value for total chromium assuming all is hexavalent chromium. If dischargers opt to speciate between hexavalent and trivalent, an alternate level will be considered.
2. This concentration is for total lead. If lead is detected above the screening level for an area

identified with TPH-g, then an analysis for tetra-ethyl lead shall be done.

3. Both soil and water standards for metals in the Migration Management Zones will be determined site specifically and must be protective of the water quality objectives upon migration into the Ecological Protection Zones.
4. Risk based levels for the zone exceeded the saturation or solubility concentrations. Therefore, since no free product is acceptable as part of the conditions of this Order, the saturation or solubility concentration will be used as the Tier 1 standard. The risk based level calculated is shown in parenthesis within the table.

TABLE 5: MIGRATION MANAGEMENT ZONE 2 TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
1. Benzene (B)	840	3,479	Water: DAF=49 Soil: OLM Model
2. Benzo(a)pyrene	12	1.5	Water: DAF=49 Soil: OLM Model
3. Chloroform	5,523	23,030	Water: DAF=49 Soil: OLM Model
4. 1,1-Dichloroethane (1,1-DCA)	731	4,851	Water: DAF=49 Soil: OLM Model
5. 1,2-Dichloroethane (1,2-DCA)	575	4,851	Water: DAF=49 Soil: OLM Model
6. 1,1-Dichloroethene (1,1-DCE)	28	157	Water: DAF=49 Soil: OLM Model
7. 1,2-Dichloroethene (1,2-DCE)	6	157	Water: DAF=49 Soil: OLM Model
8. Ethylbenzene (E)	1,566	2,107	Water: DAF=49 Soil: OLM Model
9. Methylene Chloride	>Saturation <sup>1</sup> =3,800 (13,100)	51,940	Water: DAF=49 Soil: Saturation Concentration
10. Methyl Tertiary Butyl Ether (MTBE)	-	-	Monitoring Only
11. Naphthalene	>Saturation <sup>1</sup> =810 (12,859)	4,900	Water: DAF=49 Soil: Saturation Concentration
12. Oil & Grease (TOG)	-	-	Site Specific Value to be Determined by Discharger for Executive Officer approval
13. Poly-Aromatic Hydrocarbons (Total PNAs)	12	1.5	Water: DAF=49 Soil: OLM Model
14. Poly-chlorinated Biphenols/Aroclor (Total PCBs)	0.007	0.021	Water: DAF=49 Soil: OLM Model
15. Tetrachloroethylene (PCE)	105	338	Water: DAF=49 Soil: OLM Model

TABLE 5: MIGRATION MANAGEMENT ZONE 2 TIER 1 STANDARDS			
Chemical Constituent	Maximum Soil Concentration	Maximum Groundwater Concentration	Basis for Standard (Limiting Factor)
ORGANIC COMPOUNDS	mg/kg	µg/L	
16. Toluene (T)	>Saturation <sup>3</sup> =2,800 (840,250)	245,000	Water: DAF=49 Soil: Saturation Concentration
17. Total Petroleum Hydrocarbons as Gasoline (TPH-g)	784	4,900	Water: DAF=49 Soil: Ksw=160 (Based on site specific TCLP analysis)
18. Total Petroleum Hydrocarbons as Jet Fuel (TPH-j)	3,360	4,900	Water: DAF=49 Soil: Ksw=686 (Based on site specific TCLP analysis)
19. Total Petroleum Hydrocarbons as Diesel (TPH-d)	3,360	4,900	Water: DAF=49 Soil: Ksw=686 (Based on site specific TCLP analysis)
20. 1,1,2-Trichloroethane (1,2-TCA)	224	2,058	Water: DAF=49 Soil: OLM Model
21. Trichloroethylene (TCE)	1,300	3,969	Water: DAF=49 Soil: OLM Model
22. Vinyl Chloride (VC)	133	833	Water: DAF=49 Soil: OLM Model
23. Xylene (X)	>Saturation <sup>3</sup> =990 (448,300)	107,800	Water: DAF=49 Soil: OLM Model
INORGANICS <sup>4</sup>	See Footnote 4		
24. Cadmium			inorganics to be determined site specific basis
25. Chromium <sup>1</sup>			
26. Lead <sup>2</sup>			
27. Mercury (inorganic)			
28. Nickel			
29. Zinc			

1. Chromium is the value for total chromium assuming all is hexavalent chromium. If dischargers opt to speciate between hexavalent and trivalent, an alternate level will be considered.

2. This concentration is for total lead. If lead is detected above the screening level for an area identified with TPH-g, then an analysis for tetra-ethyl lead shall be done.
3. Risk based levels for the zone exceeded the saturation or solubility concentrations. Therefore, since no free product is acceptable as part of the conditions of this Order, the saturation or solubility concentration will be used as the Tier 1 standard. The risk based level calculated is shown in parenthesis within the table.
4. Both soil and water standards for metals in the Migration Management Zones will be determined site specifically and must be protective of the water quality objectives upon migration into the Ecological Protection Zones.

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
ORGANIC COMPOUNDS		mg/kg	µg/L
1. Benzene (B)	Indoor Arpt Wrkr	1.3	1,450
	Outdoor Arpt Wrkr	2,087	>Solubility <sup>4</sup> =1,780,000 (2,324,000)
	Day Care Child	0.3	390
	On-Site Maintenance Worker	169	116,000
	Temporary Construction Earth Worker	65	6,400
	Temporary Construction General	65	5,520
2. Benzo(a)pyrene	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway
	On-Site Maintenance Worker	20	0.11
	Temporary Construction Earth Worker	5	0.44
	Temporary Construction General	3	incomplete exposure pathway
3. Chloroform	Indoor Arpt Wrkr	0.4	760
	Outdoor Arpt Wrkr	705	1,225,000
	Day Care Child	0.1	200

**TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS**

Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	On-Site Maintenance Worker	100	61,000
	Temporary Construction Earth Worker	67	6,400
	Temporary Construction General	67	6,400
4. 1,1-Dichloroethane (1,1-DCA)	Indoor Arpt Wrkr	152	135,000
	Outdoor Arpt Wrkr	>Saturation <sup>3</sup> =4,000 (244,418)	>Solubility <sup>4</sup> =5,500,000 (215,918,000)
	Day Care Child	65	57,800
	On-Site Maintenance Worker	700	430,000
	Temporary Construction Earth Worker	> Saturation <sup>3</sup> = 4,000	62,400
	Temporary Construction General	> Saturation <sup>3</sup> = 4,000	62,400
5. 1,2-Dichloroethane (1,2-DCA)	Indoor Arpt Wrkr	0.8	2,540
	Outdoor Arpt Wrkr	1,327	4,068,000
	Day Care Child	0.2	680
	On-Site Maintenance Worker	330	200,000
	Temporary Construction Earth Worker	80	7,200
	Temporary Construction General	80	10,400

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
6. 1,1-Dichloroethene (1,1-DCE)	Indoor Arpt Wrkr	0.034	50
	Outdoor Arpt Wrkr	54	75,400
	Day Care Child	0.009	10
	On-Site Maintenance Worker	6	4,000
	Temporary Construction Earth Worker	14	410
	Temporary Construction General	14	1,230
7. 1,2-Dichloroethene (1,2-DCE)	Indoor Arpt Wrkr	9	17,400
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 8,400 (15,194)	27,901
	Day Care Child	4	7,470
	On-Site Maintenance Worker	91	56,000
	Temporary Construction Earth Worker	372	5,000
	Temporary Construction General	372	36,800
8. Ethylbenzene (E)	Indoor Arpt Wrkr	869	384,000
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 3,100 (1,392,372)	> Solubility <sup>4</sup> = 152,000 (615,374,000)
	Day Care Child	373	> Solubility <sup>4</sup> = 152,000 (165,000)

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	On-Site Maintenance Worker	> Saturation <sup>3</sup> = 3,100	> Solubility <sup>4</sup> = 152,000 (246,000)
	Temporary Construction Earth Worker	> Saturation <sup>3</sup> = 3,100	7,500
	Temporary Construction General	> Saturation <sup>3</sup> = 3,100	> Solubility <sup>4</sup> = 152,000 (1,836,000)
9. Methylene Chloride (MC)	Indoor Arpt Wrkr	18.3	56,300
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 3,800 (29,344)	> Solubility <sup>4</sup> = 13,000,000 (90,212,000)
	Day Care Child	4	15,100
	On-Site Maintenance Worker	> Saturation <sup>3</sup> = 3,800	4,500,000
	Temporary Construction Earth Worker	194	54,000
	Temporary Construction General	194	54,000
10. Methyl Tertiary Butyl Ether (MTBE)	Indoor Arpt Wrkr	> Saturation <sup>3</sup> = 16,000 (118,843)	14,071,000
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 16,000 (190,523,285)	> Solubility <sup>4</sup> = 48,000,000 (22,532,784,000)
	Day Care Child	> Saturation <sup>3</sup> = 16,000 (51,052)	> Solubility <sup>4</sup> = 48,000,000 (6,030,000)
	On-Site Maintenance Worker	> Saturation <sup>3</sup> = 16,000 (65,071,082)	> Solubility <sup>4</sup> = 48,000,000 9,013,000

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	Temporary Construction Earth Worker	179	2,800
	Temporary Construction General	179	540,000
11. Naphthalene	Indoor Arpt Wrkr	> Saturation <sup>3</sup> = 810 (3,565)	incomplete exposure pathway
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 810 (1,481)	incomplete exposure pathway
	Day Care Child	> Saturation <sup>3</sup> = 810 (1,530)	incomplete exposure pathway
	On-Site Maintenance Worker	340	17,000
	Temporary Construction Earth Worker	49	3,200
	Temporary Construction General	49	incomplete exposure pathway
12. Oil & Grease (TOG)	Indoor Arpt Wrkr	Site specific value to be determined by discharger for Executive Officer approval	Site specific value to be determined by discharger for Executive Officer approval
	Outdoor Arpt Wrkr	Site specific value to be determined by discharger for Executive Officer approval	Site specific value to be determined by discharger for Executive Officer approval
	Day Care Child	Site specific value to be determined by discharger for Executive Officer approval	Site specific value to be determined by discharger for Executive Officer approval

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	On-Site Maintenance Worker	Site specific value to be determined by discharger for Executive Officer approval	Site specific value to be determined by discharger for Executive Officer approval
	Temporary Construction Earth Worker	Site specific value to be determined by discharger for Executive Officer approval	Site specific value to be determined by discharger for Executive Officer approval
	Temporary Construction General	Site specific value to be determined by discharger for Executive Officer approval	Site specific value to be determined by discharger for Executive Officer approval
13. Poly-Aromatic Hydrocarbons (Total PNAs)	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway
	On-Site Maintenance Worker	100	incomplete exposure pathway
	Temporary Construction Earth Worker	5	.44
	Temporary Construction General	5	incomplete exposure pathway
14. Poly-chlorinated Biphenols/Aroclor (Total PCBs)	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	On-Site Maintenance Worker	1	0.17
	Temporary Construction Earth Worker	1	0.16
	Temporary Construction General	1	> Solubility <sup>4</sup> = 31.0 (249,092)
15. Tetrachloroethylene (PCE)	Indoor Arpt Wrkr	25	5,280
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 2,000 (41,450)	8,462
	Day Care Child	9	2,000
	On-Site Maintenance Worker	28	17,000
	Temporary Construction Earth Worker	114	1,200
	Temporary Construction General	114	69,900
16. Toluene (T)	Indoor Arpt Wrkr	389	138,000
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 2,800 (623,180)	> Solubility <sup>4</sup> = 520,000 (221,792,000)
	Day Care Child	167	59,400
	On-Site Maintenance Worker	> Saturation <sup>3</sup> = 2,800	440,000
	Temporary Construction Earth Worker	> Saturation <sup>3</sup> = 2,800	24,700

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	Temporary Construction General	> Saturation <sup>3</sup> = 2,800	> Solubility <sup>4</sup> = 520,000 (712,000)
17. Total Petroleum <sup>5</sup> Hydrocarbons as Gasoline (TPH-g)	Indoor Arpt Wrkr	43	> Solubility <sup>4</sup> = 10,000 (48,333)
	Outdoor Arpt Wrkr	69,497	> Solubility <sup>4</sup> = 10,000 (48,285)
	Day Care Child	10	> Solubility <sup>4</sup> = 10,000 (13,000)
	On-Site Maintenance Worker	5,628	> Solubility <sup>4</sup> = 10,000 (3,862,800)
	Temporary Construction Earth Worker	2,164	> Solubility <sup>4</sup> = 10,000 (213,120)
	Temporary Construction General	2,164	> Solubility <sup>4</sup> = 10,000 (184,000)
18. Total Petroleum <sup>6</sup> Hydrocarbons as Jet Fuel (TPH-j)	Indoor Arpt Wrkr	260	> Solubility <sup>4</sup> = 5,000 (289,998)
	Outdoor Arpt Wrkr	417,400	> Solubility <sup>4</sup> = 5,000 (355,998)
	Day Care Child	60	> Solubility <sup>4</sup> = 5,000 (78,000)
	On-Site Maintenance Worker	33,800	> Solubility <sup>4</sup> = 5,000 (23,200,000)
	Temporary Construction Earth Worker	33,800	> Solubility <sup>4</sup> = 5,000 (1,280,000)

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
19. Total Petroleum <sup>6</sup> Hydrocarbons as Diesel (TPH-d)	Temporary Construction General	33,800	> Solubility <sup>4</sup> = 5,000 (1,104,000)
	Indoor Arpt Wrkr	260	> Solubility <sup>4</sup> = 5,000 (289,998)
	Outdoor Arpt Wrkr	417,400	> Solubility <sup>4</sup> = 5,000 (355,998)
	Day Care Child	60	> Solubility <sup>4</sup> = 5,000 (78,000)
	On-Site Maintenance Worker	33,800	> Solubility <sup>4</sup> = 5,000 (23,200,000)
	Temporary Construction Earth Worker	33,800	> Solubility <sup>4</sup> = 5,000 (1,280,000)
	Temporary Construction General	33,800	> Solubility <sup>4</sup> = 5,000 (1,104,000)
20. 1,1,2-Trichloroethane (1,2-TCA)	Indoor Arpt Wrkr	2.8	3,830
	Outdoor Arpt Wrkr	4,555	> Solubility <sup>4</sup> = 4,500,000 (6,139,000)
	Day Care Child	0.8	1,000
	On-Site Maintenance Worker	160	97,000
	Temporary Construction Earth Worker	259	2,600
	Temporary Construction General	259	24,500

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
21. Trichloroethylene (TCE)	Indoor Arpt Wrkr	7	4,000
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 2,800 (11,248)	> Solubility <sup>4</sup> = 1,000,000 (6,436,000)
	Day Care Child	1.9	1,100
	On-Site Maintenance Worker	530	320,000
	Temporary Construction Earth Worker	524	2,100
	Temporary Construction General	524	104,000
22. Vinyl Chloride (VC)	Indoor Arpt Wrkr	0.03	60
	Outdoor Arpt Wrkr	60	37,100
	Day Care Child	0.004	10
	On-Site Maintenance Worker	3	2,000
	Temporary Construction Earth Worker	3.2	280
	Temporary Construction General	3.2	1,230
23. Xylene (X)	Indoor Arpt Wrkr	> Saturation <sup>3</sup> = 990	> Solubility <sup>4</sup> = 175,000 (1,137,300)
	Outdoor Arpt Wrkr	> Saturation <sup>3</sup> = 990 (1,427,617)	> Solubility <sup>4</sup> = 175,000 (1,821,748,300)

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	Day Care Child	382	> Solubility <sup>4</sup> = 175,000 (488,200)
	On-Site Maintenance Worker	> Saturation <sup>3</sup> = 990 (25,550)	> Solubility <sup>4</sup> = 175,000 (831,706)
	Temporary Construction Earth Worker	> Saturation <sup>3</sup> = 990 (22,446)	139,000
	Temporary Construction General	> Saturation <sup>3</sup> = 990 (22,446)	> Solubility <sup>4</sup> = 175,000 (13,771,000)
INORGANICS		incomplete exposure pathway	incomplete exposure pathway
24. Cadmium	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	1,870	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway
	On-Site Maintenance Worker	63	incomplete exposure pathway
	Temporary Construction Earth Worker	106	17,400
	Temporary Construction General	106	incomplete exposure pathway
25. Chromium <sup>1</sup>	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	278	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	On-Site Maintenance Worker	100	incomplete exposure pathway
	Temporary Construction Earth Worker	212	34,715
	Temporary Construction General	29	incomplete exposure pathway
26. Lead <sup>2</sup>	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway
	On-Site Maintenance Worker	107	incomplete exposure pathway
	Temporary Construction Earth Worker	107	incomplete exposure pathway
	Temporary Construction General	107	incomplete exposure pathway

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
27. Mercury (inorganic)	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	35,045.8	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway
	On-Site Maintenance Worker	38.325	incomplete exposure pathway
	Temporary Construction Earth Worker	64	10,400
	Temporary Construction General	613	incomplete exposure pathway
28. Nickel	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway
	On-Site Maintenance Worker	2,555	incomplete exposure pathway
	Temporary Construction Earth Worker	4,258	694,000
	Temporary Construction General	40,880	incomplete exposure pathway
29. Zinc	Indoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Outdoor Arpt Wrkr	incomplete exposure pathway	incomplete exposure pathway
	Day Care Child	incomplete exposure pathway	incomplete exposure pathway

TABLE 6: HUMAN HEALTH PROTECTION ZONE TIER 1 STANDARDS			
Chemical Constituent	Risk Scenario	Maximum Soil Concentration	Maximum Groundwater Concentration
	On-Site Maintenance Worker	38,325	incomplete exposure pathway
	Temporary Construction Earth Worker	63,875	10,414,000
	Temporary Construction General	613,200	incomplete exposure pathway

1. Chromium is the value for total chromium assuming all is hexavalent chromium. If dischargers opt to speculate between hexavalent and trivalent, an alternate level will be considered.
2. This concentration is for total lead. If lead is detected above the screening level for an area identified with TPH-g, then an analysis for tetra-ethyl lead shall be done.
3. Risk based levels calculated for the zone exceeded the saturation concentration, and therefore since no free product is acceptable as part of the conditions of this order, the saturation concentration will be used as Tier 1 standard. The risk based level is shown within parenthesis within the table.
4. Risk based levels calculated for zone exceeded the solubility concentration, and therefore since no free product is acceptable as part of the conditions of this Order, the solubility concentration will be used as Tier 1 standard. The risk based level is shown with parenthesis within the table.
5. The Tier 1 standards for TPH-g were derived using a 3% benzene surrogate. These values may be modified based upon site specific conditons if the Discharger can demonstrate a different benzene/gasoline ratio due to weathering. To provide for overall reduction of contaminant mass, the minimum benzene to gasoline ratio that can be applied is 0.5%. Alternative levels must be approved by the Executive Officer.
6. The Tier 1 standards for TPH-d and TPH-j were derived using a .5% benzene surrogate. These values may be modified based upon site specific conditions if the Discharger can demonstrate a different benzene/fuel oil (TPH-d or TPH-j) ratio due to weathering. To provide for overall reduction of contaminant mass, the minimum benzene to fuel oil (TPH-d or TPH-j) ratio that can be applied is 0.5%. Alternative levels must be approved by the Executive Officer.

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## **Attachment 2**

### **Tier II Risk Assessment Methodology**

## ATTACHMENT 2

### TIER II SITE-SPECIFIC RISK ASSESSMENTS

This document, in conjunction with the corresponding flowchart, outlines the items and procedures required for the completion of site-specific risk assessments (Tier 2 and 3). To ensure protection for both ecological and human receptors and the Westside Basin, the gathering of adequate site-specific data and subsequent analysis is required. The Board strongly encourages the dischargers to utilize the framework provided in the American Society for Testing and Materials (ASTM) ES 38-94 "Emergency Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites" [RBCA] (May 27, 1994) or its successor when developing Tier II cleanup levels. The tiered approach, and the methodology to perform the tiered analyses in the ASTM RBCA provides a consistent decision-making tool, especially where multiple parties are involved. In addition, ASTM-RBCA was developed as a consensus procedure, has been peer-reviewed, received wide-spread input and acceptance, is internally consistent, was developed subsequent to and consistent with EPA's (CERCLA) RAGS, and fully utilizes the tiered-approach as the basis of the guide.

Details on site-specific risk assessments will be based on procedures outlined in Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities (DTSC 1992), Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) (USEPA 1989), Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities (DTSC 1994), and Guidance for Data Useability in Risk Assessment (USEPA 1992).

Prior to initiating Tier II risk assessments, a workplan must be submitted to the Regional Board for approval. The Tier II Assessment should include Sections regarding data evaluation, conceptual site models, exposure and toxicity assessment, risk characterization and uncertainty analysis. The risk goals and toxicity values selected for inclusion in this document were chosen to be consistent with values selected by the SFBWQCB staff at the May 4, 1995, meeting.

Samples from each applicable medium (e.g. soil, ground water, surface water, sediment, etc.) will be collected and analyzed for appropriate analysis as determined by historical contamination and established sampling procedures. At a minimum, compounds of concern (COCs) listed in the SFBWQCB Order must be considered as compounds of potential concern (COPCs) for the Tier II risk assessments, or an explanation must be provided for their exclusion. Statistical significance, data evaluation, detection limits, and COC selection will be determined as outlined in Guidance for Data Useability in Risk Assessment (USEPA 1992).

A site-specific conceptual site model (CSM) consistent with the CSM developed for Task 3 under the Regional Board Order dated January 18, 1995, will be presented for both human and ecological receptors. At a minimum, the CSM will include: primary sources,

guidance documents on risk assessment. Quantitative toxicity information, carcinogenic slope factors and non-carcinogenic reference doses, will be obtained, in descending order, from the most recent updates of USEPA Database: Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), and other applicable federal and state values.

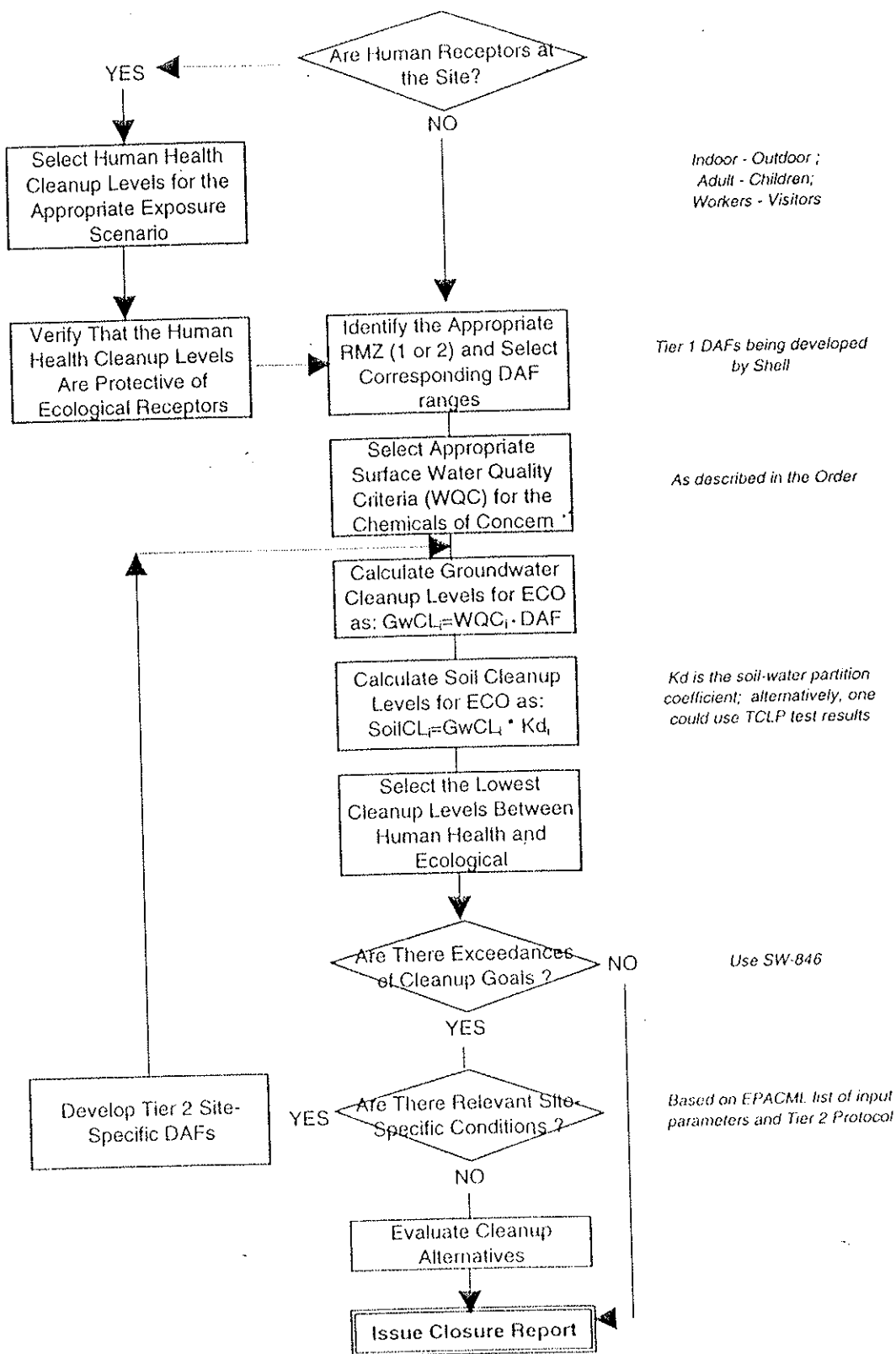
Acceptable risk and hazard will be determined based on the following criteria: the risk for individual Class A, B, and C carcinogens shall not exceed  $1 \times 10^{-5}$ , the cumulative risk for all carcinogens shall not exceed  $1 \times 10^{-4}$ . In addition, consistent with US EPA RAGS, the risk for non-carcinogenic chemicals must be summed for the COCs which either operate through a similar mechanism or affect the same target organ and the cumulative hazard from non-carcinogenic constituents shall not exceed 1.0. For sites where day care centers are proposed, the cumulative risk for all carcinogens shall not exceed  $1 \times 10^{-6}$ .

A qualitative uncertainty analysis will be performed on the assumptions, models, and variables used to quantify risk and develop RBLs.

Attachment 3 provides the exposure scenarios and input parameters used by the Regional Board to establish Tier 1 Standards and DAF Parameters for this Order. The Discharger may use the same models that were used to establish the Tier 1 Standards and DAF Parameters to develop Tier 2 Standards by modifying the input parameters and exposure scenarios provided in Attachment 3 with site specific information.

Implementation Procedure: The Discharger shall prepare a description of the methods by which they shall determine Tier 2 cleanup levels for their site. A copy of the Discharger's proposal shall be sent to the Executive Officer for review and approval. At the same time the proposal is submitted to the Executive Officer, a copy of the proposal shall also be sent to the Airport's staff and the adjacent tenants or potentially affected parties. Comments on the proposed Tier 2 analysis shall be submitted to the Executive Officer within 30 days and to the Discharger. The resulting Tier 2 evaluation and levels must be approved by the Executive Officer following the comment period.

# DECISION DIAGRAM FOR DEVELOPMENT OF CLEANUP GOALS AT SFO



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**ATTACHMENT 3**

**EXPOSURE SCENARIOS AND INPUT PARAMETERS  
FOR TIER 1 STANDARDS  
AND  
DAF INPUT PARAMETERS**

**EXPOSURES QUANTITATIVELY EVALUATED FOR  
HUMAN HEALTH PROTECTION  
PATHWAYS PROVIDED BY THE RWQCB**

Receptor Group	Exposure Pathway and Route
Indoor Airport Workers	Inhalation of Vapors from Soil and Groundwater
Outdoor Airport Workers	Inhalation of Vapors from Soil and Groundwater Inhalation of Dust
Day Care Children	Inhalation of Vapors from Soil and Groundwater
Maintenance Workers	Inhalation of Vapors from Soil and Groundwater Inhalation of Dust Ingestion of Soil Dermal Contact with Soil Dermal Contact with Groundwater
Temporary Construction Workers Earth Workers	Inhalation of Vapors from Soil and Groundwater Inhalation of Dust Ingestion of Soil Dermal Contact with Soil Dermal Contact with Groundwater
General Construction Workers	Inhalation of Vapors from Soil and Groundwater Inhalation of Dust Ingestion of Soil Dermal Contact with Soil
Subsistence Fishermen	Ingestion of Fish & Shellfish Ingestion of Sediment Dermal Contact with Surface Water Dermal Contact with Sediment

**EXPOSURE FACTORS FOR RBL CALCULATIONS  
PROVIDED BY THE RWQCB**

**General**

Target Risk	$10^{-5}$ (Day Care Children - $10^{-6}$ )	unitless
Slope Factors	USEPA IRIS/HEAST	(mg/kg-day) <sup>-1</sup>
Target Hazard Index	1	unitless
Reference Doses	USEPA IRIS/HEAST	(mg/kg-day)

**Outdoor Box Model**

Dimensions		
Ground	1.0	m <sup>2</sup>
Height	2.0	m
Wind	1.7	m/s
Paving Attenuation Factor	0.05	unitless
Contaminant Depth		
Outdoor Airport Worker	30	cm
Maintenance Worker	30	cm
General Construction	30	cm
Earth Worker	Surface	na
EPA Region IX Volatilization Factor		

**Indoor Box Model**

Area (100,000 ft <sup>2</sup> )	$9.29 \times 10^7$	cm <sup>2</sup>
Volume (1,000,000 ft <sup>3</sup> )	28320	m <sup>3</sup>
Fresh Air Exchange Rate	80	day <sup>-1</sup>
Foundation Attenuation	0.05	unitless
Contaminant Depth	30	cm

**Soil Characteristics**

Soil Bulk Density	1.5 to 2.0	g/cm <sup>3</sup>
Total Soil Porosity	0.44	unitless
Water-Filled Porosity	0.14 to 0.23	unitless
Air-Filled Porosity	0.21 to 0.30	unitless
Fraction of Organic Carbon	0.003	unitless

**Dermal Contact -Soil**

Surface Area	3200	cm <sup>2</sup>
Adherence Factor	1	mg/cm <sup>2</sup>

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Absorption Factor(ABS)		
VOCs	0.10	unitless
SVOCs	0.15	unitless
Metals	0.01	unitless
Exposure Frequency	250	days/year
Exposure Duration		
Maintenance Worker	25	years
Temporary Construction	2	years
General Construction	4	years
Dermal Absorption from Groundwater		
Surface Area	3200	cm <sup>2</sup>
Permeability Constant(PC)	Chemical-Specific	cm/hr
Exposure Time	8	hours/day
Exposure Frequency		
Maintenance Worker(2)	30	days/year
Temporary Construction	250	days/year
Exposure Duration		years
Maintenance Worker(2)	25	years
Temporary Construction	1	years
Inhalation of Dust		
Particle Concentration in Air		
Maintenance Worker(1)	100	µg/m <sup>3</sup>
Maintenance Worker(2)	1000	µg/m <sup>3</sup>
Outdoor Airport Worker	100	µg/m <sup>3</sup>
Temporary Construction	1000	µg/m <sup>3</sup>
General Construction	100	µg/m <sup>3</sup>
Inhalation Rate	20	m <sup>3</sup> /day
Exposure Time	8	hours/day
Respirable Fraction	1	unitless
FC	0.5	unitless
(fraction from contaminated source)		
Exposure Frequency		
Maintenance Worker(1)	188	days/year
Maintenance Worker(2)	30	days/year
Outdoor Airport Worker	188	days/year
Temporary Construction	188	days/year
General Construction	188	days/year

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Exposure Duration		
Maintenance Worker(1)	25	years
Maintenance Worker(2)	25	years
Outdoor Airport Worker	25	years
Temporary Construction	2	years
General Construction	4	years

Inhalation of Volatiles

Concentration in Air		
From Soil	Farmer's Model	
From Groundwater	Farmers's Model (H' constant)	
Temporary Construction	Calculated Volatilization Factors	

Inhalation Rate		
Indoor Airport Worker	20	m <sup>3</sup> /day
Day Care Children	10	m <sup>3</sup> /day
Outdoor Airport Worker	20	m <sup>3</sup> /day
Maintenance Worker	20	m <sup>3</sup> /day
Temp/Gen constr. Worker	20	m <sup>3</sup> /day
Exposure Time	8	hours/day
Exposure Frequency		
Indoor Airport Worker	250	days/year
Day Care Children	250	days/year
Outdoor Airport Worker	188	days/year
Maintenance Worker	188	days/year
Temp/Gen constr. Worker	188	days/year
Exposure Duration		
Indoor Airport Worker	25	years
Day Care Children	4	years
Outdoor Airport Worker	25	years
Maintenance Worker	25	years
General Construction	4	years
Temporary Construction	2	years

Ingestion of Soil

Ingestion Rate		
Maintenance Worker(1)	50	mg/day
Maintenance Worker(2)	480	mg/day
Temporary Construction	480	mg/day
General Construction	50	mg/day

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Exposure Frequency		
Maintenance Worker(1)	220	days/year
Maintenance Worker(2)	30	days/year
Temporary Construction	250	days/year
General Construction	250	days/year
Exposure Duration		
Maintenance Worker(1)	25	years
Maintenance Worker(2)	25	years
Temporary Construction	2	years
General Construction	4	years
Ingestion of Fish & Shellfish (Subsistence Fishermen Only)		
Ingestion Rate	100	grams/day
	(88 fish, 12 shellfish)	
FC	0.75	unitless
(fraction from contaminated source)		
Exposure Frequency	250	days/year
Exposure Duration	24	years
Ingestion of Sediment (Subsistence Fishermen Only)		
Ingestion Rate	60	mg/day
Exposure Frequency	250	days/year
Exposure Duration	24	years
Dermal Contact with Bay Surface Water (Subsistence Fishermen Only)		
Surface Area	3120	cm <sup>2</sup>
Permeability Constant (PC)	Chemical Specific	cm/hour
Exposure Time	4	hours/day
Exposure Frequency	250	days/year
Exposure Duration	24	years
Dermal Contact with Bay Sediment (Subsistence Fishermen Only)		
Surface Area	6310	cm <sup>2</sup>
Adherence Factor	1	
Absorption Factor(ABS)		
VOCs	0.10	unitless
SVOCs	0.15	unitless
Metals	0.01	unitless
Exposure Time	4	hours/day
Exposure Frequency	30	days/year
Exposure Duration	24	years

**CALCULATION of DILUTION ATTENUATION FACTORS (DAF)**  
San Francisco International Airport Site Cleanup Requirements -- June 21, 1995

**EPACML INPUT PARAMETERS**

Transient Simulation = 300 yrs

**Chemical Specific Variables**

Organic Carbon Adsorption Coefficient, $K_{oc}$	0 100 1000	Worst Case, Typical VOC Typical SVOC
Biodegradation Rate Constant, $\Lambda$ , %/day	0, 0.2	Worst Case/Recalcitrant Typical for BTEX

**Source Specific Variables**

Infiltration Rate, in/yr	0.204 +/- 0.072	Rainfall data will be collected from weather station at the SFIA. Infiltration rate is assumed to be 1% of rainfall.
Recharge Rate		Equal to infiltration rate.
Source Area	2.0 +/- 0.5 acres	Normal Distribution Min. = 0.5 Max. = 5.0
Source Decay Constant	0	Worst Case Scenario, Continuous Steady-State Source

**Vadose Zone Material Variables**

Saturated Hydraulic Conductivity	Silty Loam	Default Values from EPACMCL will be used. (Avg. $K = 10^{-4}$ cm/s)
Vadose Zone Porosity	Silty Loam	Default Values from EPACMCL will be used.
Air Entry Pressure Head	0	Default Value from EPACMCL
Depth of Unsaturated Zone	2 +/- 0.5 m	Normal Distribution Min. = 1.0 Max. = 3.0

**Vadose Zone Transport Variables**

Thickness	2 +/- 0.5 m	Equal to Depth of Unsat. Zone
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Longitudinal Dispersivity	Calculated	Using EPACMCL's empirical correlation for this factor: $\alpha_L = 0.02 + 0.022 D$ where D is the Thickness of Vadose
Per Cent Organic Matter	0.034 +/- 7.74	Default Value from EPACMCL-SB Distribution

**CALCULATION of DILUTION ATTENUATION FACTORS (DAF) (continued)**  
**San Francisco International Airport Site Cleanup Requirements -- June 21, 1995**

**Aquifer Specific Variables**

Hydraulic Conductivity	$10^{-3}$ cm/s +/- $2.5 \times 10^{-4}$	Typical case based on field data (VSE report)
Porosity	Calculated	Using EPACMCL's empirical correlation for this factor
Aquifer Thickness	3 +/- 1m	Normal Distribution Min. = 1.0 Max. = 10.0
Source Thickness (Mixing Zone)	Calculated	Using EPACMCL's empirical correlation for this factor: $H = (2\alpha_v L)^{1/2} + B(1 - \exp(-\frac{LI_f}{V_s \Theta B}))$ where H = Source thickness $\alpha_v$ = Vertical dispersivity L = Source length B = Aquifer thickness $I_f$ = Infiltration rate $V_s$ = Seepage velocity $\Theta$ = Soil water content
Hydraulic Gradient	0.00 +/- 0.0002	Normal Distribution Min = 0.001 Max = 0.05
Longitudinal Dispersivity	Default	Gelhar Distribution
Transverse Dispersivity	Default	Gelhar Distribution
Vertical Dispersivity	Default	Gelhar Distribution
Fractional Organic Carbon	0.003 +/- 0.0003	Using Default Distribution from EPACMCL

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Receptor Distance	150m (500 ft) 305m (1000 ft) 457m (1500 ft)	
Angle Off Center	0	Worst Case Along Centerline
Receptor Vertical Distance	Uniform Distribution	Require receptor to be within soluble plume.